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What is your financial position?
What defects exist in your business?

How to analyze a financial statement to find answers to these and other important questions is told in an instructive article in this issue entitled

"FINANCIAL STATEMENTS"

by

J. J. Berliner, B. C. S.
Senior Member National Accounting Systems

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Pit and Quarry

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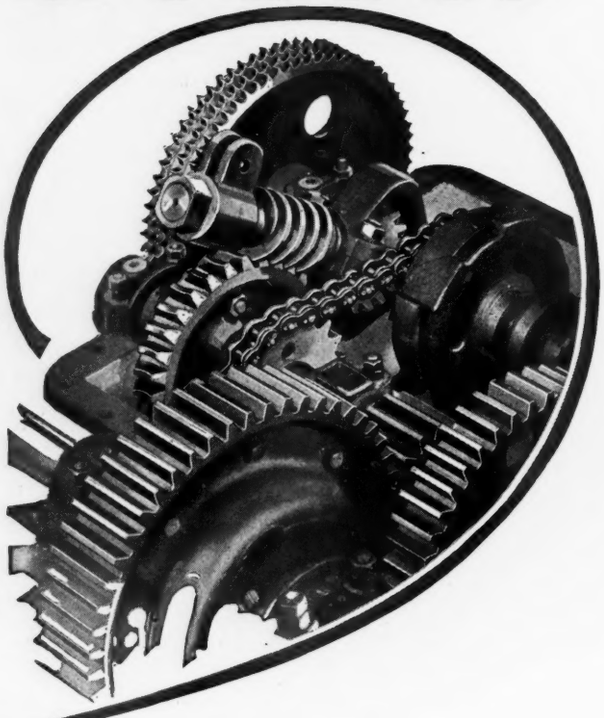

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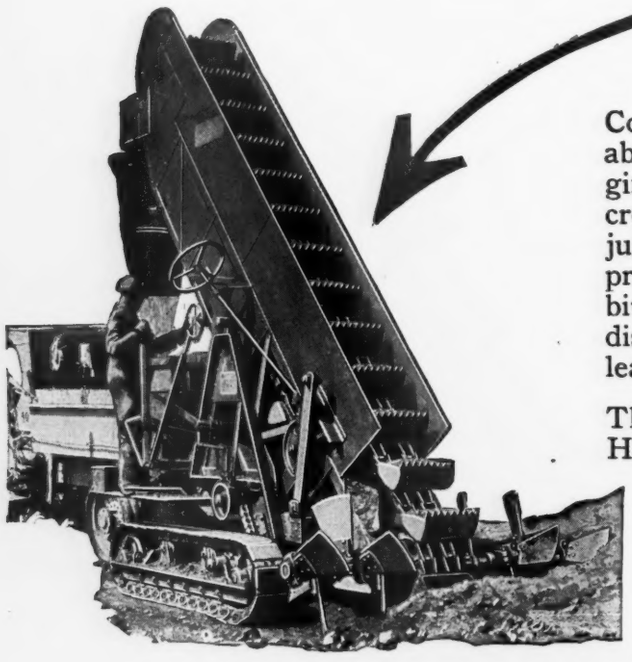

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Pit and Quarry

Vol. 14 CHICAGO, ILL., AUGUST 31, 1927 No. 11

USE YOUR NATURAL YEAR TO ADVANTAGE

THE question of when to close the fiscal year is a problem that every corporation must face and decide. The influence of the requirement of a Federal tax return has been on the side of making the fiscal year coincide with the calendar year. After a careful survey of some 60 lines of business, the Bureau of Business Research of the University of Illinois concludes that this is a mistake, and produces weighty arguments to prove that it is better to base reports and accounting on the natural fiscal year.

By the natural fiscal year is meant the period that comprises and completes the fullest round of the firm's activities. The "coal year," for example, ends about April 1, in the lull that follows one season's activity and precedes the next. It is then that wage contracts are made. The statement drawn up on the basis of the calendar year does not reflect the real course of business. Unless the calendar and the natural year happen to coincide, the calendar year statement will cover parts of two business seasons.

Financial statements prepared at the end of the natural fiscal year have more value to the management and to bankers, because they reflect the results of a rounded period of activities. Inventory is easier to take when stocks are low and employees are not rushed. Around January 1 there is a great pressure on accounting firms. They could give better service at other times.

Bankers are deluged with statements at the beginning of the year. If these were more evenly distributed they could give them more careful attention. At the close of the natural year there is less temptation to "dress up" statements, and such statements form a better basis for comparison with other firms and between different industries. They furnish, therefore, much more valuable credit information.

The end of the natural year is also the best time to formulate new plans, and a statement at that time is a real help in estimating the next year's prospects and making borrowing arrangements and labor contracts. Many concerns might find substantial advantage in adopting this recommendation and basing their accounting on their own natural year.

LOOK OUT FOR TARIFF REDUCTION

WITH the final report of the World Economic Conference at hand, it is now possible to summarize and evaluate the results of that meeting. It must be remembered that although the representatives to that conference included many well-known economists and business leaders, yet they were entirely without power to bind their respective governments to any line of action. With 194 members, attended by 157 experts drawn from 50 different countries in all quarters of the globe, the Conference relied for tangible results on the effect which its deliberations and conclusions might have on governments and on public opinion.

Among the chief recommendations of the Conference were:

1. Reduction of the economic burden of armaments.

2. International agreement on terms, methods and scope of industrial statistics, with widest dissemination of industrial and agricultural information.

3. All possible measures to liberate international trade from artificial restrictions and obstructions, i. e.:

a. Removal of import-export restrictions.

b. No special privilege to state-controlled undertakings.

c. Fair treatment of foreigners and foreign enterprises.

d. Simplification of customs, tariffs and practices.

e. Reduction in import or export duties by individual, bilateral, or collective action.

f. Removal of discriminations against imported goods.

Obviously it is the last group that chiefly affect the United States. American enterprise is reaching

out all over the world. American owned companies are operating in foreign countries to a constantly increasing degree. The tendency in all countries, especially in the undeveloped ones, is to welcome the American enterpriser and investor with open arms, until he has built up an industry and made a substantial capital investment that cannot be withdrawn without heavy loss.

Then the tune changes. The "foreign octopus" is then "sucking the life-blood of the people." Any profits made by the foreign firm are represented by "patriotic" politicians and labor agitators, as wrung from the toil and sweat of the poor natives, even though the foreign enterpriser has actually opened up a new way for the natives to make a living, furnished a market for their products, and employment for their labor. Taxes and legal penalties are then devised to confiscate the profits, or local politicians must be "fixed" to ward them off.

The heart of the recommendations is the effort to lower tariffs. Let the American industrialist see to it that his opposing voice is clearly and distinctly heard in this regard. Unless opposition makes itself heard now we may face tariff reductions in 1929 or 1930.

BUILDING CONSTRUCTION AND OUTLOOK

AS POINTED out by the United Business Service, the persistence with which the dollar figures of building and engineering contracts have kept up with, and now surpass, the record figures of last year, has exceeded general expectations and has proved a powerful support to general business. Since the figures for contracts awarded are in dollars and the cost of building has declined more than 2 per cent during the past year, the actual physical volume of construction is really substantially more than 2 per cent ahead of that for the first half of 1926.

The total of construction contracts awarded during June, in the 37 states reported in the Dodge figures, was $632,478,000, which set a new monthly record. This was an increase of 16 per cent over June, 1926, and of 15 per cent over the previous month. It brings the total for the first half of 1927 up to $3,187,993,300, 2 per cent more than the first six months of last year. Indications are for the continuation of high volume.

There have been, however, important changes as between the various classes of construction that go to make up the total. Square feet of floor space from January 1 to July 1 is still about 5 per cent behind that of the first six months of 1926. There has been therefore, so far this year, about that much less of actual building construction. The larger total dollar figures for all construction are obviously due to conspicuous gains in the item of public utility and engineering projects, amounting to over 10 per cent increase.

Building costs have remained fairly constant since early in 1926. Materials have declined consistently, but building wages have continued to advance. In the districts in which construction activity has declined there has been, of course, less employment. With little formal change in wage rates, even in such districts, labor has become more efficient, since competition for employment has been keen.

The outlook for building labor is mixed. It has been our view that building wages were unduly inflated, and we expected to see a downward movement before now. But where construction volume is maintained at present high levels, there appears little chance for substantial declines in wages. In those districts, however, in which activity has fallen off we still believe that labor will be forced to make further concessions. The fact that contemplated projects in June were 14 per cent less than in May and 10 per cent under the preceding June suggests that the record figures for contracts awarded in June took up an undue proportion of the demand and portend a slight decline in future awards. July construction contracts, however, reached a total of $534,399,900, according to F. W. Dodge Corporation. This represents an increase of 3 per cent over July of last year and brought the total of construction started during the past seven months up to $3,722,393,200. This is an increase of 2 per cent over the first seven months of last year.

MISTAKES ARE EXPENSIVE

MEN who claim that they have never made a mistake are either liars or loafers. Human nature is fundamentally imperfect, and because of this mistakes are made wherever human nature is a factor in employment. In every business, whether it consists of making calico dresses, selling ice cream cones, keeping books, or manufacturing Pit and Quarry products, errors of various kinds are constantly being made. Recognition of the fact that "to err is human" renders it necessary to study the problems involved in each particular business enterprise with the aim to prevent all unnecessary chances of mistakes.

Mistakes are expensive. They cause waste of time both in the making of the mistake and in the correction after discovery. The effect on everybody concerned is bad. Errors cost customers money, time, material, men, or jobs, depending upon the nature of the business and the tolerance of the one on whom the brunt of the error falls.

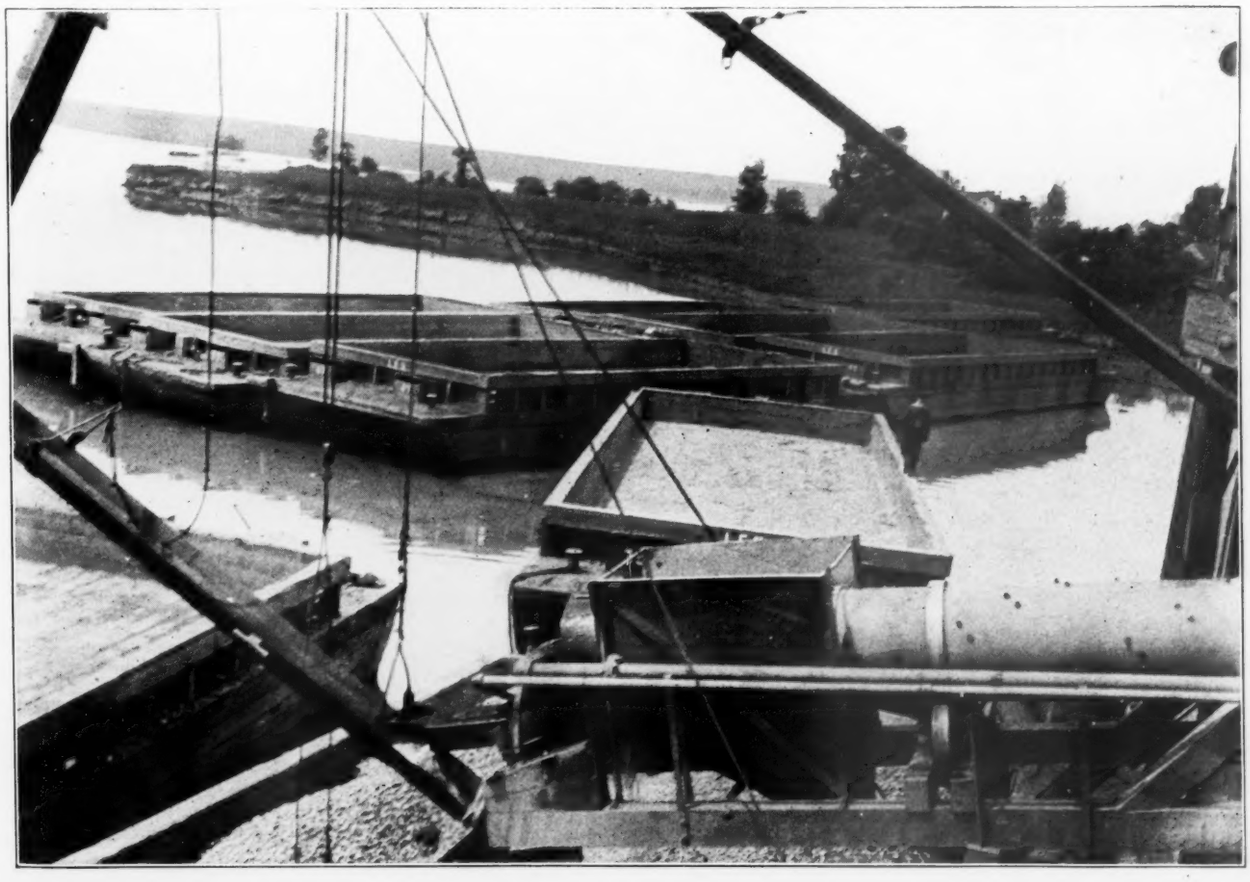
SMOOT SAND AND GRAVEL CORPORATION BELIEVES IN QUALITY AND EFFICIENCY

By R. P. Brown

LOCATED in Washington, D. C., and getting their material from the historic Potomac River, the Smoot Sand and Gravel Corporation, is well known in that territory as producers of clean sand and gravel which meets specifications. The plant, from the dredges on through their two yards, is run on an efficiency and quality basis. T. G. Herbert, who is the General Superintendent, has been with Lewis E. Smoot, President of the company for over 25 years. In fact, most of the men connected with the organization have never been with any other concern. Donald M. McNeale is Secretary and Treasurer, and Thomas A. Butt holds the position of Purchasing Agent. J. A. Woodward, M. E., assisted by Alvin Parker, is kept busy in charge of the mechanical engineering work.

The Smoot Sand and Gravel Corporation operates two specially designed dredges, and controls a large acreage of sand and gravel beds along the Potomac river dredging also from the beds in the river. In general, the deposits run about 66 per cent sand and 34 per cent gravel. One bank where

Concrete Bins of 6,500 Tons Capacity

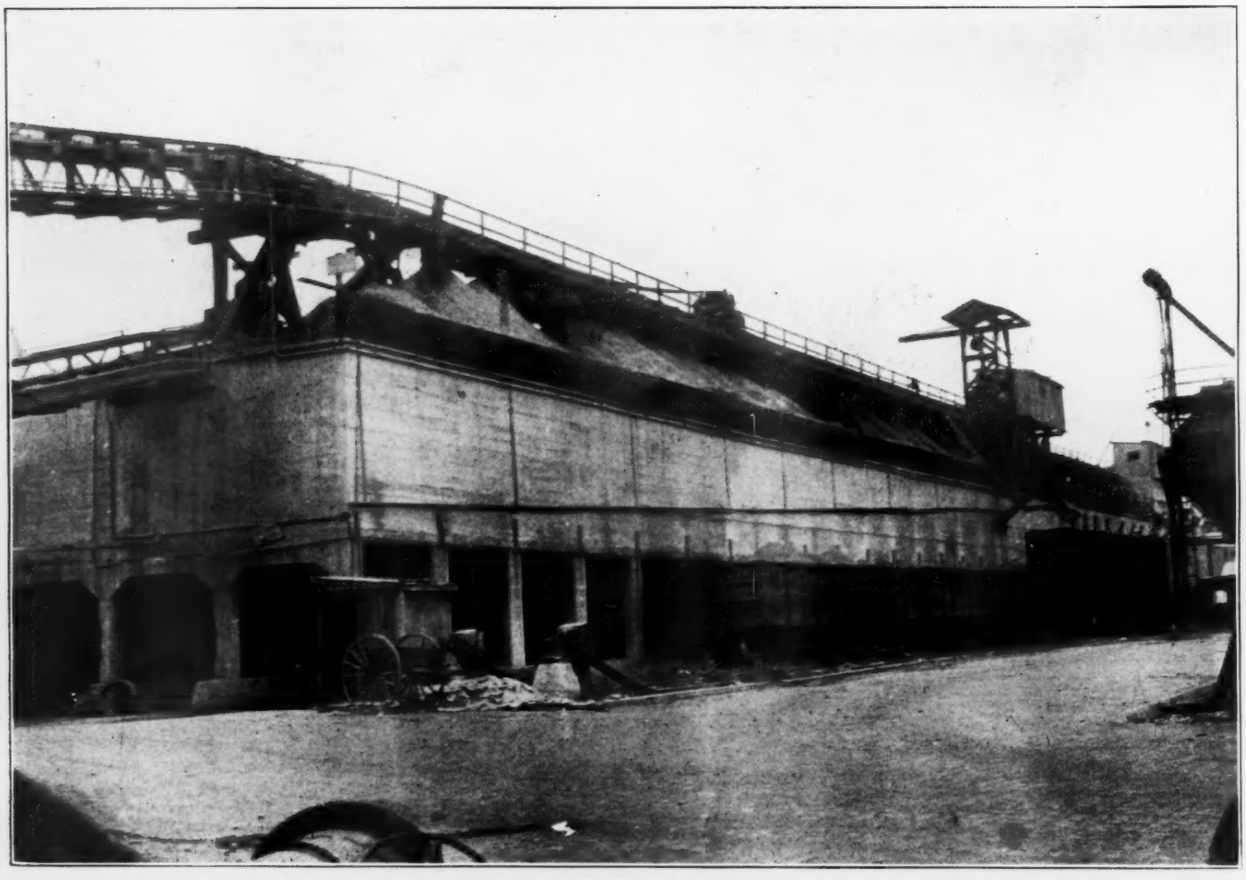


View Showing Barges and Gravel Scrubber

Stockpiling System, Excess Material Spills Over Concrete Bins and is Handled by Locomotive Crane

they are now operating has an overburden of about 2 feet of clay, and the other bank has only about 4 feet. This overburden is practically all above water level at low tide. The deposits vary from 35 to 50 feet in thickness, and are worked by bucket dredges, both machines being very similar in construction and equipment.

The dredges are symetrically designed and are well balanced, sand being delivered from one side and gravel from the other. Their position is maintained or shifted at will by manipulation of four 60 foot spuds and two anchors which are fastened to the shore, the operation being controlled from the operator's cabin. Each spud is operated by a



General View of Concrete Bin Storage

Lambert single drum hoist. The four spud hoists, two on each side of the hull, are connected by a cross shaft, driven by a 9x10 Lambert hoisting engine. The two anchor shift drums are also operated from this same shaft.

The material is taken from the deposit by means of 7 cubic foot one-piece manganese steel buckets with detachable manganese steel lips and lugs, the buckets being strung four links apart on the chain, the boom being 58 feet long. The bucket chain and gypsie are operated by an Atlas engine. As the buckets bring up their load, and the operator keeps them running full, they discharge through grizzly bars spaced 6 inches on centers into a 5 foot steel cone with 2⅝ inch perforations which culls out and rejects oversize material, sending it down through the hull. This cone discharges into a revolving screen 15 foot long with $\frac{5}{16}$ inch perforations which separates and gives a first washing to the sand and gravel, water being supplied through a 4 inch pipe which is perforated along the lower 9 feet of its length.

The sand is collected in a hopper under the screen and flows through chutes to a specially constructed and patented Dorr washer which finishes its cleaning. Additional clean water is used to wash the clean sand down an inclined chute over a series of screens to the scows waiting alongside the dredge. On the other dredge a Dull cone is used instead of a Dorr washer. The grading of the sand is effected by means of the screens set in the chute. The scow nearest the dredge carrying the Dorr washer is loaded with building sand, which will all pass a number 10 screen, and the outer scow receives the concrete sand, all passing a number 4 screen. Each scow loads 165 cubic

Conveyor Feeding Bins

Excellent View of Sand Washer

Gravel Comes up Conveyor in Foreground Feeding Through Washer to Lower Horizontal Conveyor. Sand Goes on Upper Conveyor

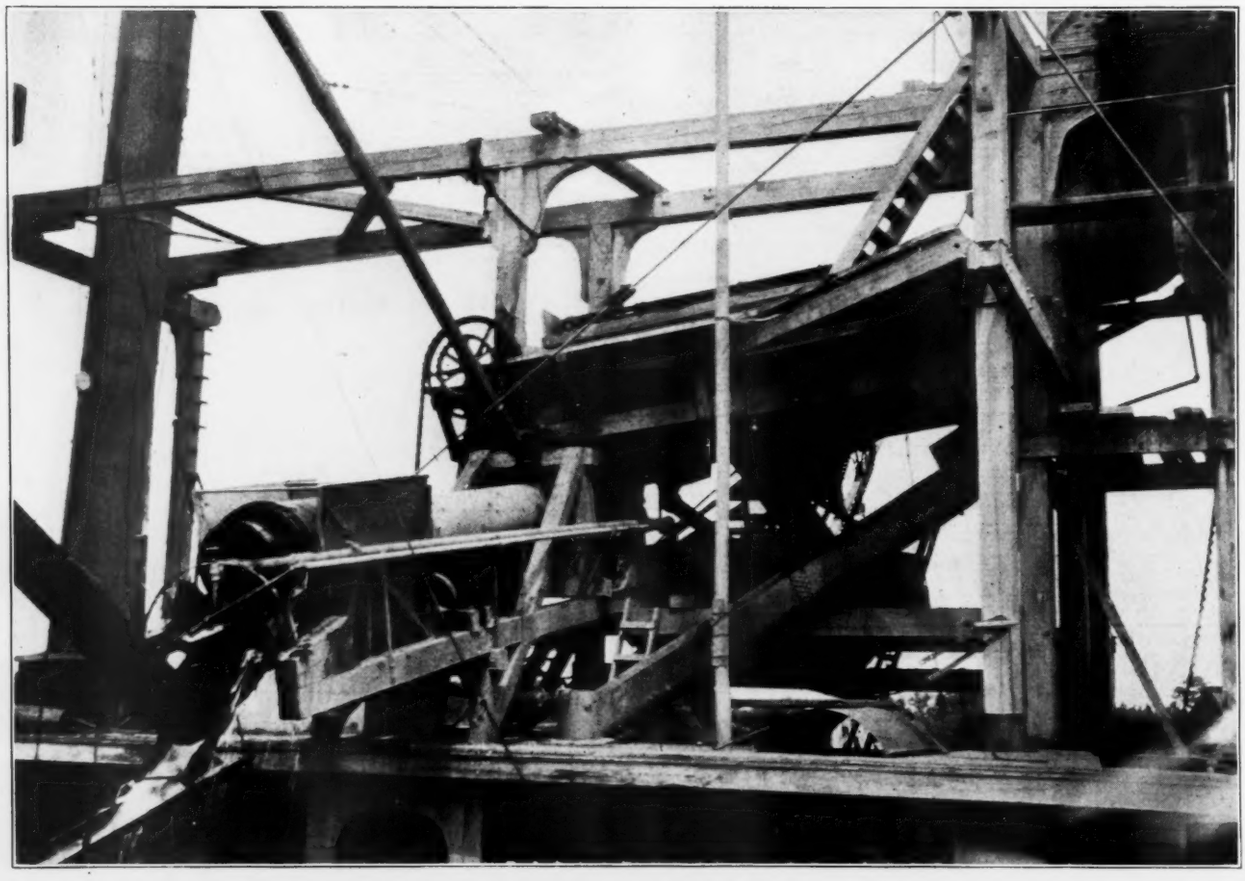
yards of material, and the dredge will load from 1,000 to 1,500 cubic yards of sand and gravel per 12 hour shift.

The gravel which passes the main separating screen goes on to a specially designed and patented scrubber where it is still further cleaned and graded. Different sizes of gravel, from that which all passes a ¾ inch screen up to that which all will pass a 2½ inch screen can be prepared under normal conditions and without special equipment. Under special conditions gravel can be, and has been, shipped where cobbles up to 4 inches in diameter were required. Ordinarily, however, the call is for either all material passing a ¾ inch screen, or else all passing a 2½ inch screen.

A Lambert engine drives the main screen and gravel scrubber, together with the Dorr washer, driving through a 12 inch Goodyear belt. A Worthington single stage centrifugal pump, direct connected with a Terry steam turbine, furnishes 2,500 gallons of water per minute for washing and floating the material into the scows, while current for lighting and operating the refrigerating plant and water cooler is furnished by direct connected generators operated by Engberg engines. All steam is furnished by a 200 H. P. Scotch Marine boiler, and all steam pipes are heavily covered to prevent loss of heat.

Good accommodations are furnished on each dredge for 12 men, each dredge operating 24 hours a day with two shifts. Four men on deck take care of the scows, one handles the top, and two the engine room. One cook takes care of meals for both shifts, and the captain and runner complete the crew. Captains Walter Weaver, A. T. Courtney, Raymond Sanford, and B. Willett take care of and operate the two dredges. The kitchen and mess halls are kept scrupulously clean and the food served is of the best, well cooked and in abundance.

Three tugs handle the 35 scows that bring the material from the dredges to the two yards that the Smoot Sand and Gravel Corporation operates. One yard takes care of the local demand in the Eastern



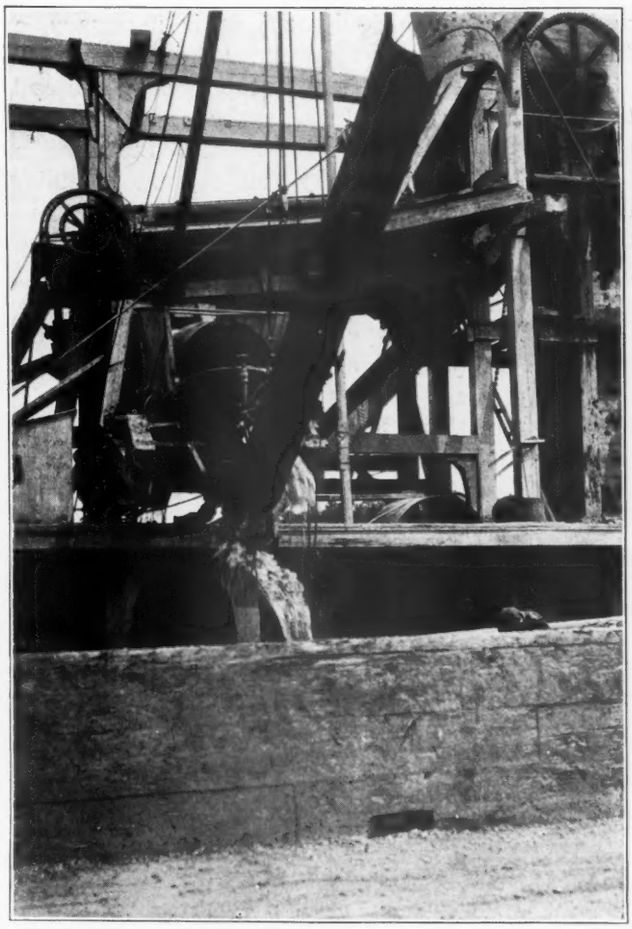
General View of Dredging Mechanism. Gravel Scrubber at Left. Grading Screen Top Center. Sand Washer in Background.

section of Washington, while the other, and larger one, takes care of the demand from the Western half of the city where a great deal of construction is in progress, and handles also the rail shipments. This yard, where the main offices are located, has concrete bin storage for 4,000 tons of sand and 2,500 tons of gravel, and stockpile storage for still another 25,000 tons of material. All sand and gravel is delivered to cars or trucks through the bins.

Two cranes, one floating and the other an Ohio Locomotive crane, both equipped with 1½ cubic yard Hayward clamshell buckets, unload the scows as they are brought to the main yard, taking about 1 hour per scow. At the eastern yard the material is unloaded by a Mead-Morrison automatic railway, fed by a clamshell bucket. Two shovelers in the scow spot and feed the buckets.

As the sand is unloaded at the main yard it goes through a hopper to a 24 inch rubber belt conveyor 118 feet and 8½ inches between pulleys, operating at a speed of 220 feet per minute, driven by a 15 H. P. Westinghouse motor. This belt feeds the main belt, also 24 inches wide, 265 feet and 3 inches between pulleys, which fills the bins, traveling at 300 feet per minute. This belt is driven by a 30 h. p. Westinghouse motor. On this belt a Link Belt traveling tripper operates, filling any bin as desired. The bins are kept filled at all times, any surplus spilling over to the stockpile and being moved by the locomotive crane to the auxiliary stockpile if necessary or returned to the bins as needed. During the busy season this crane is constantly at work.

The floating crane ordinarily handles the gravel as it comes in, taking it from the scows and dumping it through a hopper which holds about 30 cubic yards. This hopper feeds a 24 inch rubber belt conveyor 61 feet and 8¼ inches long, which carries the material to the rotary washer and screen where it is given the final washing and grading. A 10 h. p. Westinghouse motor drives the conveyor. The washer and screen, 12 feet long, and with $\frac{5}{16}$ inch perforations, is specially designed to dewater the material and is extremely efficient. It is driven by a 15 h. p. Westinghouse motor, while the wash water is supplied by a Frederick Iron and Steel Co. centrifugal pump furnishing 500 gallons of water per minute. The pump is directly connected to a 15 h. p. motor. The washer and screen discharge to a 24 inch rubber belt conveyor, 392 feet and 10½ inches between pulleys, which carries the material to the bins, where it is unloaded by a Robins traveling tripper as required. This belt travels at 350 feet per minute and has a capacity of 200 tons per hour, as do all the belts. It is driven by a 40 h. p. Westinghouse motor. Of course a duplicate tripper is kept on hand for each main belt so that the plant will not be tied up at any time by a breakdown of these vital parts.



Specially Patented Gravel Washer and Scrubber Discharging to Scow

Three driveways for trucks run under the concrete bins, and a Baltimore and Ohio spur holding 8 cars extends along the east side of the bins. Twelve spouts lead from the gravel bins to the cars and three cars may be loaded with gravel at the same time, five minutes being sufficient to load a 50 ton car. If the bins happen to be low, either sand or gravel may be loaded directly from the conveyor belts through special chutes. Seventy-two hand-operated gates at the bottom of the bins take care of loading trucks with gravel, two bins each being kept full of ¾ inch pea gravel, while the balance ordinarily is 2½ inch material. Sixty loading gates are necessary to handle the demand for concrete sand, and a like number take care of the building and asphalt sand.

From the loading driveways the trucks pass out over two 20-ton Fairbanks platform scales, each scale being equipped with the Weightograph attachment graduated to read directly to tons and hundredths of tons, this equipment being made by the General Automatic Scale company. Two men handle the scale house and can each take care of weighing a load and writing the ticket per minute during the rush hours. A speaking tube and enclosed basket carrier connects this scale office with the main office.

In order to keep all equipment in good shape

and to make such equipment as is necessary, a fully equipped repair shop under the charge of J. B. Crawford is maintained by the Smoot Sand and Gravel Corporation. In this shop all necessary equipment to make machine repairs, including a 300-ton, 18 inch stroke hydraulic press is maintained. Incidentally, this press is the largest in the city of Washington and has proved its value to the company many times.

With such a plant it is no wonder that the Smoot Sand and Gravel Corporation does a large annual business. They have furnished material, either all or part, for many famous structures in and around Washington. The Francis Scott Key Memorial Bridge, which spans the Potomac within a quarter of a mile from their main office, is one of the structures where they cooperated with another company to supply specially prepared aggregate.

Outgrown Building Code Restrictions Protested by Engineers

"Architects and engineers throughout the country must wage a determined fight against certain outgrown restrictions imposed by building codes that impede progress and prohibit use of new and improved construction methods and materials," declared Joshua D'Esposito of Chicago at a recent meeting of 20 different committees of the Western Society of Engineers held at the Engineers' Club in that city. "Such action is necessary if members of our professions are to be permitted to exercise their imagination and use their ability in helping to build up the nation." Mr. D'Esposito is chairman of the Western Society's building code committee, consulting engineer for the recently completed Chicago Union Station and chairman of the construction committee of the new Chicago Civic Hall.

"For officials, many of whom are unpracticed in construction, to set down hard and fast rules about the kinds of materials to use and the strains to which these may be put, and to keep these provisions in the code long after new discoveries are made, is like a law that would tell doctors they must use castor oil for certain diseases whether or not the physician thought that was the right thing to do," Mr. D'Esposito said.

"When, for example, there is recalled the opposition to an effort made last year to modernize the Chicago code by allowing use of a more modern form of building tile, we can realize that the building code committee of the Western Society of Engineers and similar groups of architects and engineers throughout the country not only have a task but a real fight on their hands. Similar restrictions exist in almost every city to hinder construction progress.

"Such limitations, perhaps adopted years ago before the days of modern scientific construction, still remain on the books to hamper use of improved materials and methods. If they were strictly followed, modern construction would not be so strong and dependable as it is today. These antiquated restrictions encourage breaking of codes in order to meet the many requirements for modern projects either by a deliberate failure to observe the codes or by covering up the work in such a way that it will pass unnoticed."

The essential difference between the practical work of architects, engineers and contractors and the theoretical work involved in codification of building ordinances and laws was pointed out by the speaker. "Construction practice is fluid and never can be fixed," he said. "Codes unfortunately tend to remain static and unprogressive. What may have been good practice yesterday is uneconomical today because of new discoveries in the handling and making of construction materials and new methods of using them to fit the increasing needs of growing communities. Simple narrow streets give way to wide double-decked projects. Two- and three-story buildings are replaced by 40-story skyscrapers. Huge trucks and motor busses displace the old-fashioned horse and wagon, and 100,000-pound-capacity freight cars take the place of what we now would consider dinky boxes.

"That fundamental changes both as to materials and methods occur in a comparatively short time in the construction field was pointed out recently in a well-known engineering and construction journal in an obsolescence study of an office building erected 35 years ago. 'It is evident,' the article states, 'that even some of the basic principles of construction have changed in the relatively short period between the year 1892 and the present time. We have no assurance or reason to feel that these principles will not improve again in the coming 35 years.' To keep pace with these changes and with the growing needs," said Mr. D'Esposito, "the old-fashioned ideas behind building codes should be changed so as to allow even better work on huge construction projects and, what is of still greater importance, the requirements of building codes should be set down by architects and engineers rather than by those who have little or no practical knowledge of the real requirements and who sometimes are influenced by political considerations rather than by technical principles."

Business Failures Compared

During the first half of this year, business failures showed an increase of 5 per cent or 597 failures compared with the same period during 1926. Liabilities were 31 per cent greater with the increase representing 78 million dollars. Business failures are closely associated with the volume of business and a decline brings a proportionate increase in failures.

FINANCIAL STATEMENTS A MEANS OF ANALYZING YOUR BUSINESS

By J. J. Berliner

RENDERING of financial statements, and the ability to properly analyze them are of great importance. The importance of financial statements lies in the fact that if properly constructed, construed and compared with previous statements, they furnish the best criteria of the condition of the business, its management and its tendencies over a period of time. From the financial statements can be ascertained what the profits are; what the financial position of the concern is; and whether there are any defects in conducting the business. Financial statements consist of two statements: One is known as the "Income, Profit and Loss" statement; the other is known as the "Balance Sheet" statement.

Income Statement

The "Income, Profit and Loss" statement may be properly defined as an analytical summary of the income derived from the business transactions of a commercial enterprise over a definite period of time, such as annually, semi-annually, quarterly or monthly. It is a classification in brief form of all the items entering into and affecting the income, its sources of derivation, its cost of procurement, and finally, its disposal.

Although differing in many minor respects, because of the lack of uniformity in the accounting field, all income statements are similar in the main divisions. The following is a skeleton "Income, Profit and Loss" statement showing the essential divisions:

Gross Income from Operations.
Less Cost of Operations.
Net Income from Operations.
Add All Other Income.
Total Income.
Less Fixed Charges.
Net Profit.
Less Dividends.
Surplus.

"Gross Income," or "Operating Income," as it is sometimes called, is the income derived from the concern's principal line of business. Income derived from other business sources is not included in gross income, but comes under the caption of "Other Income." The "Cost of Operation," or "operating expense," is the total cost, and expenses incurred in obtaining the operating income. The gross income, less the cost of operations, gives us the net income from operations. Under the operating expenses are included such items as the following: Cost of materials, selling expenses, administrative expense, general expenses, etc.

In the case of sole proprietor or partnership, the net profit for the period is credited to the proprietor's capital or to the partner's capital accounts, as the case may be. In a corporation, the remainder left, after deducting dividends, is added to the surplus at the beginning of the period, giving the total surplus at the end of the period. The following is an "Income, Profit and Loss" statement suggested by the Federal Trade Commission as a standard for various commercial groups:

COMPARATIVE INCOME STATEMENT

	Total	3 months Ending 3-31-26	3 months Ending 6-30-26
Gross Sales			
Less Outward Freight			
Allowances and Returns			
Net Sales			
Inventory at beginning			
Add Purchases Net			
Less Inventory Ending			
Cost of Sales			
Gross Profits on Sales			
Selling Expenses (Itemized)			
Total Selling Expenses			
General Expenses (Itemized)			
Total General Expenses			
Administrative Expenses (Itemized)			
Total Administrative Exp.			
Total All Expenses			
Net Profit			
Other Income			
Investments			
Interest			
Total Income			
Deductions from Income			
Interest on Bonded Debt			
Interest on Notes Payable			
Total Deductions			
Net Income			
Profit and Loss			
Add Special Credits to Profit and Loss			
Deduct Special Charges from Profit and Loss			
Profit and Loss for Period.			
Surplus at beginning of Period			

"Fixed Charges," are those payments which must be made to keep the concern intact. Such usually are interest on mortgages, bonds, and taxes, etc. "Net Income," is the income left after all deductions of expenses. From the net profits are usually deducted the dividends, assuming that the concern is a corporation, and the management has declared one.

Income Statement Analyzed

Gross sales are the total amount of sales made for the period. From the gross sales are deducted the following items, giving the net sales: (1) Outward freight and cartage, which is the expense incurred in shipping merchandise sold at the concern's own expense; (2) sales allowances, which are credits allowed to customers for goods received in damaged or unusable condition; (3) sales returns, which are goods returned for various reasons, such as incorrect goods delivered, etc.

Having ascertained the net sales, the next step is to find the cost of these sales. This is done in the following way: To the inventory, at the beginning of the period, are added the net purchases, made for the period of time covered by the "Income, Profit and Loss" statement. From this total is deducted the inventory at the end of the period. Factory cost of operations includes such items as cost of materials, labor, depreciation, heat, light and power, supplies, etc. After arriving at the cost of sales, it is deducted from the gross sales, leaving the "gross profits on sales."

From the "gross profits on sales," are calculated the net profits on sales by deducting the following expenses: (1) The selling expenses under which caption is included such items as: Salaries of salesmen, traveling expenses, advertising, etc.; (2) after which are deducted the "General Expenses," which include items such as printing, general office expenses, etc.; (3) "Administrative Expense" (which is the cost of conducting the business) includes such items as: salaries of officials, legal expenditures, etc. Deducting the total of these expenses from the gross profit on sales, we obtain the "net profit on sales."

To the net profit on sales is then added all other income derived from outside business sources. Such are income from investments, interest on notes receivable, interest on book balances, cash discounts on purchases. From the total of the net profits on sales and "other income" are deducted the fixed charges. This includes such items as interest on bonded debt, interest on notes payable, cash discount on sales, etc. This leaves us the net income for the period.

Next may be added special credits to Profit and Loss, if there are any. Such usually are profits derived from the sales of property or securities. Special debit charges to Profit and Loss are usually the writing off and cutting down of good will, organization accounts and patents. We now have the Profit or Loss for the period. If the concern is incorporated, the surplus at the end of the period is then determined. This is done by deducting any dividends declared by the company from the profit for the period, and then adding the surplus at the beginning of the period, giving us the total surplus at the end of the period. In sole proprietorship, or in partnership, the profit for the period is added to the capital accounts.

Balance Sheet

The Balance Sheet statement is the index of a company's financial strength. It is a summary of what the concern possesses and is to receive from its debtors; what it owes and is to pay to its creditors. To be able to accurately interpret a company's financial condition and tendencies over a period of time requires, in addition to the analysis of the Balance Sheet, a comparison with previous Balance Sheets of the same concern. The following page shows an illustration of a Comparative Balance Sheet of an incorporated firm.

Balance Sheet Analyzed

Fixed Assets.—The fixed or capital assets are those of a permanent character and which could not be disposed of by the business organization without seriously impairing its operations. Under fixed assets are included such items as land, buildings, plant and equipment, furniture and fixtures, goodwill, patents, trade marks, etc.

Working and Trading Assets.—Those assets which are necessary in the manufacturing. They include all the inventories, such as: Raw materials, work in process and finished goods.

Current Assets.—Those assets which can quickly be converted into Cash. Included under this caption are such items as: Cash on hand, and in bank; notes receivable; accounts receivable; securities and debts due to the business, date of maturity being less than one year.

Deferred Assets.—Expenditures which have been made for the benefit of future periods and are treated, therefore, as assets. Such, for instance, are: Insurance prepaid; advertising prepaid; rent prepaid, etc.

Liabilities and Capital.—By capital stock is meant the actual liability of the company to the shareholders for capital paid in, or subscribed to, and to be paid in. Capital stock may be divided into common and preferred stocks, of which the corporation is authorized to issue up to a specific amount by its charter. Unissued stock is stock still remaining in the company's treasury, or not subscribed to, the issued being in the hands of the stockholders.

BALANCE SHEET OF X Y C CO. AS OF

	Dec. 31, 1926	Dec. 31, 1925	Dec. 31, 1924
Assets:			
Fixed or Capital Assets			
Plant and Property			
Furniture and Fixtures ...			
Investments (Long Term) .			
Goodwill			
Trade Marks			
Total Fixed Assets			
Working and Trading Assets.			
Inventories			
Total Working and Trading Assets			
Current Assets:			
Cash			
Accounts Receivable			
Notes Receivable			
Securities			
Due from Subscribers to Stock			
Total Current Assets ...			
Deferred Assets			
Total Assets			
Liabilities and Capital			
Capital Stock			
Preferred Stock Authorized			
Less Unissued			
Issued and Outstanding ...			
Common Stock Authorized.			
Less Unissued			
Issued and Outstanding ...			
Total Capital Liabilities.			
Current Liabilities:			
Accounts Payable			
Taxes Accrued			
Payroll Accrued			
Interest on Notes Payable, Accrued			
Dividends Payable			
Total Current Assets ...			
Reserves:			
Reserves for Depreciation of Building			
Reserves for Depreciation of Equipment			
Reserves for Bad Debts ..			
Total Reserves			
Contingent Liabilities:			
Surplus			
Total Liabilities and Capital			

Current Liabilities.—Those liabilities which must be paid out of current assets and must be paid, at the latest, within one year. They include such items as: accounts payable; notes payable; loans payable; accruals, etc.

Deferred Liabilities.—The opposite of deferred assets, being income received in advance, and not yet earned. The portion unearned is set up as a deferred credit to income, because they represent a liability of the concern to deliver service in a later period.

Accruals.—Expenses which are due and are unpaid as yet. Such are: Taxes accrued; wages accrued; interest accrued, etc.

Reserves.—A reserve is a credit amount created by setting aside a certain portion of the profits or surplus for some specific or general purpose.

Examples of such are: Reserves for depreciation, which are created for the purpose of replacing loss suffered by a physical unit through wear and tear.

The capital of a concern is the difference between the assets, into which the contributions of capital have been converted, and the liabilities incurred, as a result of its activities. To put it more briefly: Assets — Liabilities = Capital.

Contingent Liabilities.—Those liabilities which may, or may not, materialize, depending on the occurrence of a certain event, or arising out of past transactions. A common example of such is the case where a note receivable has been discounted, and where the maker of the note is unable to pay. The liability, therefore, falls upon the concern as guarantor of the principal, and interest on the debt of the other firm.

Significance of Ratios

Current Ratio.—This ratio is derived by dividing the current assets by the current liabilities. It indicates the margin between the amount currently due, and that currently owing. This excess or margin of the current or liquid assets over the current or liquid liabilities is known as the "working capital." Without sufficient working capital, no business concern can operate efficiently. Many troubles are caused by the shortage of working capital, such as: Shortage of material, losses of discounts, etc. Current assets usually should be about 1½ to 2 times the current liabilities. It is extremely important to know how the working capital stands, for it enables one to know whether he is operating efficiently, and what his position is in meeting current bills falling due.

Net Worth of Fixed Assets.—This ratio is derived by dividing the net worth (assets less liabilities) by the total fixed or non-current assets. It indicates the percentage of net worth or owner's equity, tied up in plant, machinery, equipment, and other fixed assets. The margin over and above 100 per cent indicates the proportion of the net worth provided for working capital. If the ratio shows that the net worth to fixed assets is decreasing, because of an increase in net worth, then the conclusion may be reasonably drawn that the owner

is expanding the plant more rapidly than the normal growth of the business warrants.

Sales to Accounts Receivable.—This ratio is found by dividing the total net sales for the year by the total of accounts, and notes receivable. It indicates the proportion of the annual sales which are carried on the books as receivable, and denotes the economy and efficiency observed in handling capital tied up in receivables. By dividing the sales by the accounts receivable, we get the turnover of the accounts receivable for the year. To illustrate, let us assume sales for the year are $200,000, and that the accounts receivable are $20,000. The turnover of accounts receivable is 200,000 ÷ 20,000, which is 10. If we wish to determine the number of days of sales carried on the books, we simply divide 10 into 365 days, the result being 36½ days. This enables us to know how the accounts receivable outstanding compare with our selling terms and whether they are under normal or above normal.

Sales to Merchandise.—To secure this ratio, divide the net sales by the total merchandise inventory. This ratio enables us to determine the stock turnover. The stock turnover can be found (1) by dividing total sales by the average selling value of the merchandise on hand, or (2) by dividing the approximate cost of all goods sold by the cost of the average stock kept on hand. In order to indicate clearly the two methods of determining stock turnover, two illustrations are submitted:

1. SALES PRICE BASIS

$$\frac{\text{Total sales at selling price ($100,000)}}{\text{Inventory at sales price ($25,000)}} = \text{Turnover (4 times)}$$

2. COST BASIS

$$\frac{\text{Total sales at Cost ($70,000)}}{\text{Inventory priced at cost ($17,800)}} = \text{Turnover (4 times)}$$

Another common method of determining the stock turnover on a cost basis is to take the merchandise inventory on hand at the beginning of the fiscal period and add to it the cost of manufacturing. From this deduct the merchandise on hand at the end of the year. The resulting figure is the amount of merchandise at cost price that has been sold during the year, which, when divided by the average inventory at cost, gives the stock turnover for the year.

For illustration:

Merchandise on hand at beginning of year	$20,000
Purchases during year	67,500
Total	$87,500
Less merchandise on hand at end of year	17,500

Stock turnover $70,000 ÷ 17,500 = 4 times.

Knowing how to calculate the stock turnover, enables one to ascertain whether he is properly managing his business. Rapid stock turnover indicates good management, fresh stock and liquid assets. A slow turnover on the other hand reflects too large an investment in merchandise, careless buying, and possibly dead stock.

Operating Ratio.—The net sales or gross income divided by the total operating expenses gives us the operating ratio. Thus, if the sales are $100,000, and the operating expense is $40,000, the ratio may be expressed 2.5 to 1, or 5 to 2. It means that it costs on the average of $1 to sell $2.50 worth of goods, or $2 to sell $5 worth of merchandise. This ratio serves as an index of the business efficiency. Thus, a declinig operating ratio normally indicates improved efficiency.

In conclusion, we may say that the value of financial statements in business cannot be overestimated. The analysis of financial statements gives the executive insight into the condition of the business at a given time—at the time the statement is prepared. The business is inspected and scrutinized, as if it were at a standstill. Much valuable information can be disclosed by comparing the essential items at different dates, and by noting the changes in the rates at these intervals. It is from such comparisons that the management can thus accurately determine whether the business is improving, standing still or retrograding.

Building Wages Studied

A study of construction in about 130 cities has been made officially by the United States Department of Labor and shows that the level of wages in the construction industry has been advancing since 1923 at a faster rate than the prices which contractors ask for finished structures. Reports have been received by the department from practically all principal cities. These reports cover union wage scales of all building crafts together with advices concerning the value of permits issued to build. The department has constructed an index taking 1914 as the base year. The index shows that in 1923 the wage level showed an advance of 103 per cent over 1914. In the same year the price of the finished building or cost to the purchaser showed an advance of 104 per cent above 1914. In the following year the wage scale was 120 per cent above 1914, while the cost was 107 per cent higher. In 1925 wages were up 128 per cent and cost 112, while in 1926 wages showed an advance of 143 and cost 119. Data for 1927 are not yet obtainable. From 1914 to 1920 cost advanced faster than wages. In that year cost was 135 per cent above 1914, and the wage level showed an advance of 93 per cent.

PUBLIC WANTS SOMETHING DIFFERENT NOW FINDS LANNON QUARRIES CORPORATION

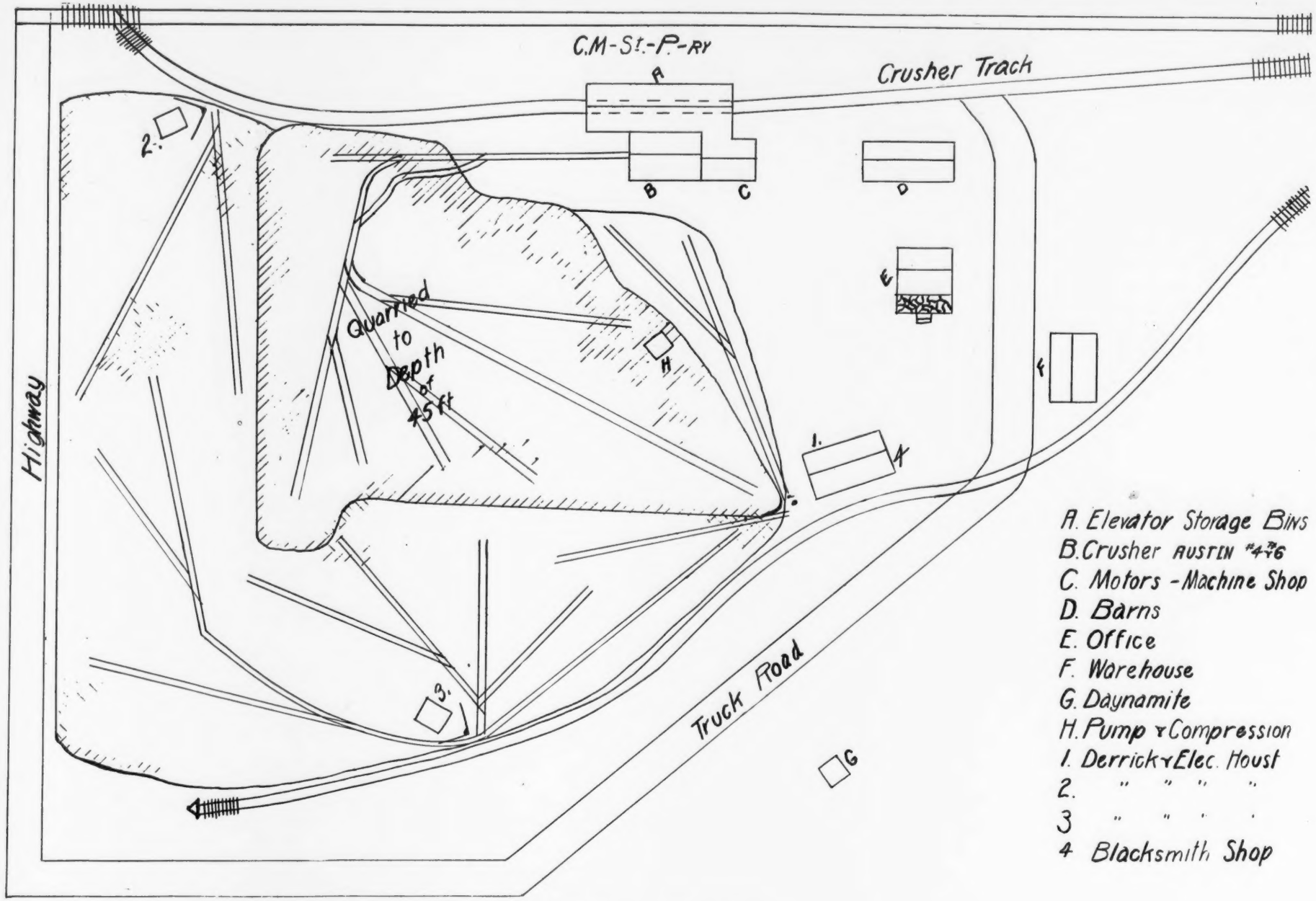
SOMETHING different is desired today in a home by a prospective builder. He prefers, and is increasingly demanding, something different in a home from that of his neighbor. Realization of this fact resulted in the Lannon Quarries Corporation taking certain steps three years ago that have been completely justified this year.

In the first place, this company owns quarries in the heart of a region noted for natural formations. The stone is remarkably adapted to varied treatment to correspond with practically any effect in architecture that may be desired. The stone is suitable for a variety of purposes including wall stone, window sills, lintels, chimney blocks, quaint effects in the garden or yard, entrance ways, corner stones, corner posts, etc. These facts led Lannon Quarries Corporation to concentrate on developing a business in special stone for the public that desires something different. A crushed stone business is also carried on, and a plant with a capacity of 500 tons per ten hours absorbs the tailings from the special stone operations and keeps the quarry clean.

Experience of others with the public has developed the fact that the public likes its merchandise in an attractive package, and that a high-grade article goes better with a dignified name. Accordingly, the Lannon Quarries Corporation elected to merchandise their stone with an identity and so labeled it Monogram Lannon Stone. An advertising campaign was laid out which included the publication of an attractive booklet entitled, "Building Beauty With Stone." This booklet was expensive, but it brought results. The distinctive characteristics of Lannon stone are discussed in a manner to create a real desire for the beauty and individual character resulting from the use of this stone. The great variety of products and the unlimited individual effects are suggested in a manner to stimulate the prospective home builder's imagination. A number of excellent examples, all different and artistic, are attractively illustrated. The sales appeal is clinched by clever references to the permanence and increased value of a home of which Monogram Lannon Stone is a part.

Another merchandising rule employed has to do with the fact that the public likes to find an easy way to act. The Lannon Quarries Corporation makes this possible through a service department offering a free consultation service on building problems, landscape gardening, and treatment and uses of Monogram Lannon Stone. An estimating department prefaces estimates directly from the architect's plans. Suggestions are made either in conjunction with or independent of architects. The prospective home builder is assured that any effect desired can be had, within the limitations of the stone, and any stone will be cut to special specifications if desired.

View of Quarry from Derrick Number 2, Looking Toward Crusher Buildings

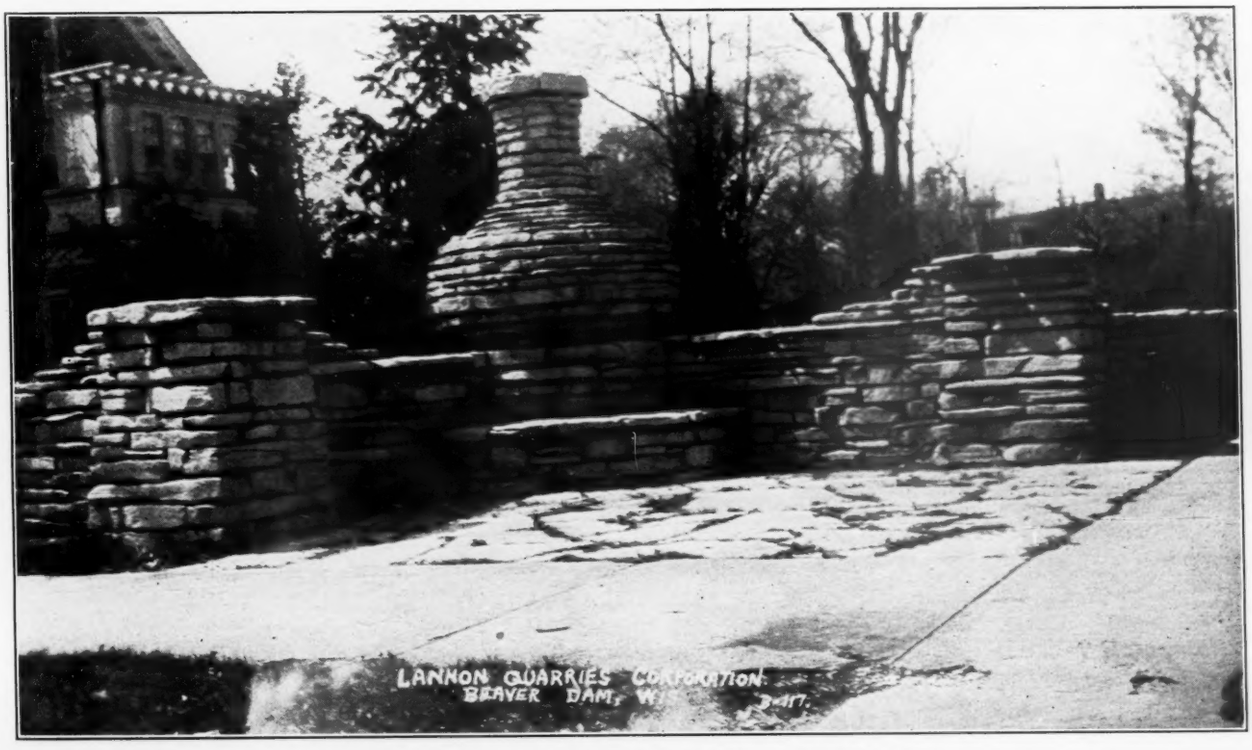


Layout of Quarry and Buildings

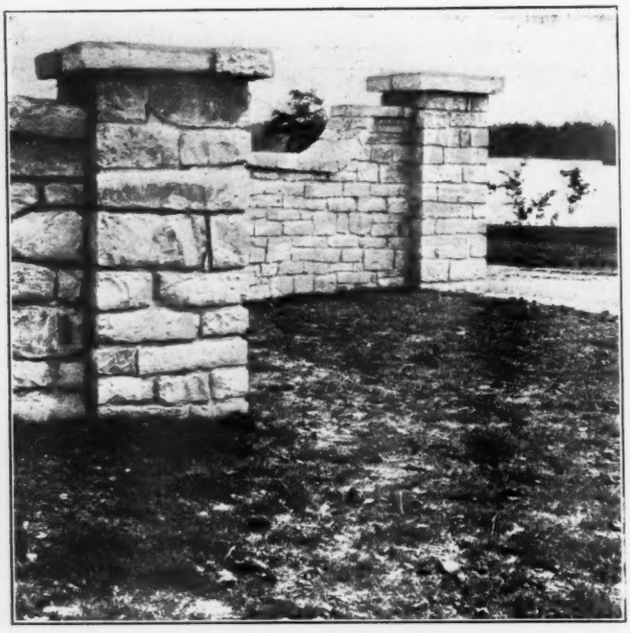
Early in its experience the Lannon Quarries Corporation discovered that inexperienced men are expensive at any price, especially in quarrying the class of stone that exists at Lannon, Wisconsin. By carefully selecting men and by putting helpers with each man for training a group of men has been developed that should be rated with the best in the business. The outstanding factor among these employees is that they take a surprising pride in their work.

In March, 1924, C. A. Starkweather was obliged to take over sixteen acres of quarry property at Lannon, Wisconsin, on a mortgage. After repeated efforts to dispose of the property at a loss of $3,000 failed, Mr. Starkweather decided to operate the property. The crushing plant and other

Building Stone as Taken From Ledges, Not Yet Trimmed for Shipment



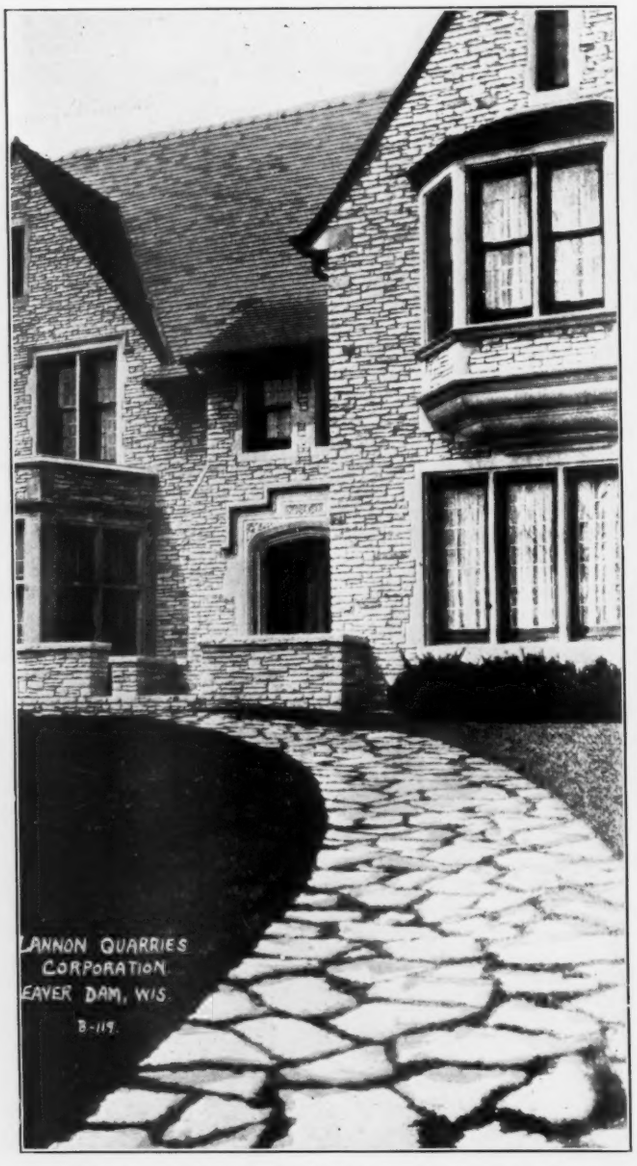
Example of Architectural Gardening Using Trimmed Stone



A Picturesque Stone Entrance

equipment was in bad shape. An investigation disclosed the fact that while Wisconsin was doing an enormous amount of concrete roadwork, there was already plenty of material for this purpose. Profits must come from some other market. Further investigation developed the fact that the deposits contained excellent building and artistic stone. The market for this stone was nearly wide open. The result of all this meditation carried Mr. Starkweather into the business outlined above.

The quarries have a face of 40 feet. The bottom 20 feet is a hard blue limestone that compares favorably in crushing strength with granite. The top 20 feet is in layers ranging from 2 to 8 inches in thickness. These varying thicknesses add greatly to the artistic appearance of walls and buildings. The thinner layers serve the market for flagging which has become very popular for walks and drives. The upper layer is traversed by innumerable crevices, down which water has carried mineral deposits for centuries tinting the stone from light yellow to deep brown. It is this



Residence and Flag Walk Made of Lannon Stone

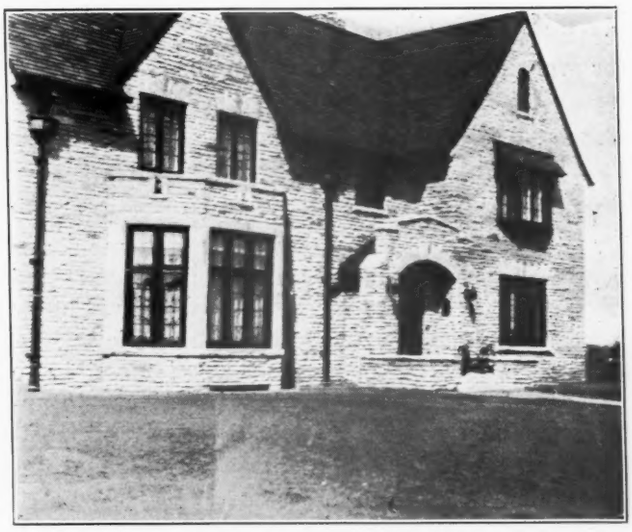
Another Residence of Lannon Stone

coloring feature that has made the stone famous. The edges of the layers have been washed and worn by the water, creating natural shapes and effects that are distinctive. One of the illustrations shows the layout of the quarries and buildings. The shaded area shows the portions opened to a depth of 40 feet. The level of the quary is lowered whenever necessary to produce rip rap, crushed stone, etc. The area of the double headed lines covers building stone blocks.

The crushing plant has a capacity for 500 tons per ten-hour day. This plant at present is operating at about one-half capacity. Two Austin crushers, a number 4 and a number 6, handle the crushing. The plant is electrically operated throughout. Steam shovels are used in removing the overburden. Two miles of 3-foot industrial track is laid in the quarry. Tailings from the building stone operations are thrown over the ledge into a deeper quarry ledge and transported by quarry cars to the crushing plant.

A second quarry was opened up two years ago. This is a low hill from which weathered edge is produced. This product is used extensively for pools, garden walls, etc. A large quantity of flagging and stepping stone is also produced at this quarry in addition to building stone. There is no crushing plant at this quarry, because all the stone is worked up into a marketable product. Next year a third quarry will be opened up from which weathered edge and steppers will be the main product.

During the three years the plant investment has been more than trebled. Virtually every building



Residence of Gordon Osborne, Made of Lannon Stone

on the property was rebuilt. Considerable new equipment has been added. The tracks have been extended. With the improvements planned for next year, the Lannon Quarries Corporation will have one of the most modern of plants producing stone at a minimum cost. And all this has been done out of profits.

Last January, the present Lannon Quarries Corporation was incorporated. The officers include C. A. Starkweather, president and treasurer; A. T. Zimmerman, vice president, and A. M. Young, secretary. The products marketed include standard building stone, veneer stone, mineral tinted stone, thick weathered edge, weathered stepping, standard weathered edge, heavy and light rip rap, select

Palatial Home Made of Lannon Stone, Where Corners and Openings Have Been Emphasized by Special Trim

flagging, rubble stone, crushed limestone, limestone screenings, agricultural limestone and cut stone for every purpose bush hammered or rock faced.

Invoicing Industrial Relations

We are all thoroughly familiar with methods of inventory. It is a matter that comes to our attention at least once each year, and during that period frequently with some force. But while we know how and are accustomed to counting articles in a bin it would seem strange if not impossible to apply the inventory to industrial relations—to appraise the morale and relationship of payroll members with the same certainty that we now appraise the value of physical property.

Yet such is being done—with considerable profit. Stock-taking in the man-management field is growing in universality. As the Metropolitan Company has put it: "Although the attitude of the working force would seem to be an intangible thing, any experienced executive can go into an establishment and soon tell just what the outstanding facts about the relationships are. The place where the spirit of confidence prevails does not give the same impression as one where confidence is absent.

"And the production and spoilage records tie up closely with the presence or absence of an attitude of maturity."

The Rotary International of Chicago has been actively interested in summing up some fundamental principles of industrial relations, and this, it seems to us, is an intelligent step forward in supplying a basis for measurement—of applying concrete, practical thinking to the human element in organization. According to one statement "employees should feel that they belong to the business; that each part of their work helps to run that machine or the entire organization."

As a means to this end the Pennsylvania Railroad system suggests six principles which are considered the "essentials of right for the other fellow." These are: 1, Steady employment; 2, a good wage; 3, time for recreation; 4, opportunity to elevate one's self; 5, a voice in determining rules and regulations under which one shall work; 6, a fair divisin of the profits after a reasonable wage has been earned and a sufficient amount of paid capital to attract it to an expanding business."

Such is the yardstick with this railroad when they attempt to determine the status and value of employee relations. All these help reinforce the inventory idea. Their regular application to the plans and relationship in process tell a valuable story. It pays to take stock of human relations in any business, for the human being is a much more valuable and tangible asset to the success of a business than are machines, buildings and so-called fixed assets.

Encouraging Employees in Thrift

More than 12,000 employees of a large western oil company have recently received the certificates of stock in that company for which they had paid through a partial payment stock purchasing plan. At the inception of this plan the company had agreed to match every employee's dollar with 50 cents of its own, thereby accelerating the speed of saving and encouraging the acceptance of the plan. At the time of distribution it was found that the 12,000 employees had accumulated a total of nearly $16,000,000 worth of stock and that the company had contributed approximately $8,000,000.

There is nothing new in such a plan. Similar "profit sharing" arrangements, with variations, have been tried by other industrial firms with a greater or lesser degree of success. That such plans encourage thrift on the part of the worker as well as partially bind him to the company with the development of self-interest and the incurrence of obligation is readily acknowledged by all. The unusual part of the Pacific Coast incident is found in the fact that the company has discontinued the plan. There will be no further opportunity for employees to purchase company stock on the partial payment basis, at least for the present. Discontinuance was made because the company wished to know what the employees are going to do with their savings. If the majority keep their certificates and regularly add the dividends to the principle with the view of further accumulation, the plan will doubtless be reinstated. On the other hand, if a large proportion of the workers sell their certificates in order to buy automobiles or other luxuries, it will be apparent that the 50-cent incentive was a rather poor investment, and the plan abandoned.

It will be interesting to watch the developments of this case. It is our opinion that the plan will eventually be reinstated because we have faith in the average American workman. It is true, a great many Americans disposed of their Liberty bonds and went on a spending orgy during 1919 and 1920. Probably a portion of the 12,000 California stockholders will do likewise. But the plan has been in operation for more than five years, and such a period makes for the establishment of habit. We do not think the worker with three or four children, who has put a little money away each month toward the purchase of his stock will suddenly and foolishly dispose of his savings. In the main we believe such plans, while they impose a heavy burden and obligation on the management, are a mutually profitable venture. Home and property owners make the best possible workers. The encouragement of thrift among employees makes home and property owners. Perhaps the inauguration of some such plan in your own establishment might be worth consideration.

PARTICLE SIZES OF ADMIXED SUBSTANCES IMPORTANT IN MAKING CONCRETE PRODUCTS

By H. Richarz*

WITHIN the last few years much attention and weight have been attached to the size of the particles of admixed substances that are used in the manufacture of concretes and cement products. It has become known that the density of a concrete, which has a naturally important relationship with its strength, is dependent to the highest degree on the composition of the added substances. Very comprehensive and important investigations have been carried out with the express purpose of determining the most favorable relations between the size of particles of the various ingredients and these researches have been published in the trade literature. However they are too difficult of interpretation and too comprehensive for the practical man.

It is for this reason that the principle and most important conceptions and experimental conclusions of these highly scientific investigations are given here in a clearly and easily understandable fashion, in addition to certain original investigations and practical experiences of the writer himself. The importance of this matter lies in the fact that it behooves not only the large institutions with their research chemists and engineers to use the best proportions in making their cement products, and to choose the most favorable size of particles in the admixtures, but also the average sized and smaller companies that cannot afford to have research laboratories but who nevertheless must also choose the correct sizes of particles and the correct proportions in order to produce the proper grade of cement products. This article is therefore particularly directed at these smaller companies, and especially for the reason that the importance of the size of particles has not been appreciated so much by the manufacturers of cement products. And it is just here that this matter is of prime importance. For the demands for thin-walled cement wares and products of small dimensions have introduced problems which are properly solved only when a correct knowledge of the effect of the size of the particles of the admixed substances on the properties of the cement mixture is available.

It is of great importance in making most cement products that the surface of the article be smooth, for this gives the latter a good appearance. The choice of proper admixed substances is highly pertinent in this connection. It often happens that just fine sand and cement are used in making products of small dimensions. Thus a concrete post (dimensions 16x10x160 centimeters) was made with a mixture of fine sand and cement in the proportion of one part by volume of cement to five parts by volume of pure sand. The reinforcement consists of four round iron bars of nine millimeters diameter. The outward appearance of these posts was very fine indeed, for their surface was very smooth, but after they had been used for four weeks, it was found that they did not have sufficient strength to stand up against the wear and tear to which they were subjected. One of the principal faults was that the concrete did not adhere properly to the iron bar reinforcement, for when these posts were subjected just to slight shock, they fell entirely to pieces. This was naturally to be expected. For due to the sole use of the pure sand the surface of the admixed substance was so large that the quantity of cement employed was not sufficient to produce a good article, or in other words it was not sufficient to cover all of the surface of the sand.

A simple mathematical study teaches us to what extent the surface area of the admixed substance is affected by the fineness of the particles. It may be assumed that all the particles of the admixed substances are spheres. It then becomes unimportant as to what cross-section is taken of the particle and it is, of course, represented in a plane diagram by a circle. If we, therefore, take a circle with a radius r which is set equal to unity, then the circumference of the circle is equal to 2×3.1417 (pi) $\times$ r or $2 \times 3.1417 \times 1$ or 2 pi.

Then from the same circumference which is equal to 2 pi, it is possible to form two circles. Then the radius is r equal to 0.5. The circumference of each of these two circles than is equal to $2 \times 3.1417 \times 0.5$ or pi. The circumference of the two circles is, however, equal to 2 pi. The circle which is marked II in figure 1 has a radius equal to 0.5. If the radius of the circle is called 0.25, then it is possible to construct four circles whose combined circumferences are also equal to 2 pi. The circumference of each circle is then equal to $2 \times 3.1417 \times r = 2 \times 3.1417 \times 0.25 = \frac{1}{2}$ pi or $\frac{1}{2} \times 3.1417$. When this result is multiplied four times, then we have 2 pi.

Bearing this information in mind, we can now examine Figure I once more. The two circles (II) whose radii is equal to 0.5, in spite of the fact that the circumferences have the same length as the circumference of the largest circle (I), enclose a much smaller surface, and the four small circles with the radii (III) 0.25, in spite of the fact that their circumferences is equal to that of the large

*From Tonindustrie Zeitung.

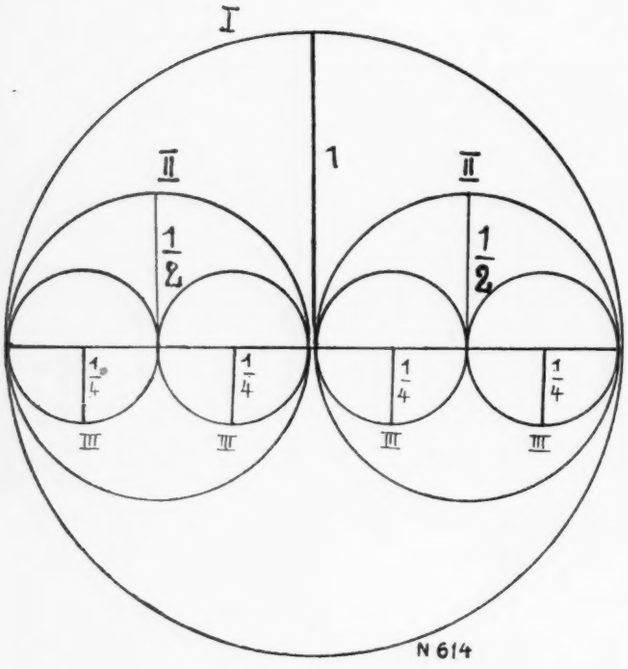


Figure One

circle I enclose a still smaller area, smaller even than that of the two circles II with the radii equal to 0.5. It is possible to express in mathematical terms the magnitude of the reduction of surface area, when the circumferences remain equal but when the radii are shortened.

Thus the area of a circle is set equal to $J = r^2pi$. In the case of circle I, the radius is 1, and then we have $J = 1^2.pi = pi$. In the case of circle II the radius is equal to 0.5, and the expression for the area then becomes: $J = (0.5)^2.pi$ or 0.25pi. Inasmuch as we have two circles with the radius 0.5, this area must be multiplied by 2 and we thus have the total area equal to 0.5pi. In the case of circles III the radius is equal to 0.25 and the expression for the area then becomes: $J = (0.25)^2.pi$ or $\frac{1}{16}pi$. But four circles were drawn each with a radius equal to 0.25 and hence the area must be multiplied by 4 which gives the result 0.25pi. It thus follows from this study that the surface area of the various circles with the same circumferences (in toto) is reduced in proportion with the reduction in the individual radii.

The information which has been developed above regarding the radius of a circle, its circumference and its area may be similarly applied to the sphere, which is the assumed form of all the particles. It thus follows that when the same surface area which covers a large body is divided up into smaller bodies whose total surface area is equal to that in the first, the total cubic contents of the smaller bodies must be less than the volume of the larger body. Or when this is considered in an inverse manner if we wish to substitute a number of smaller bodies of the same total weight for a larger body of certain definite weight, then the total surface area of the smaller bodies must be considerably greater than the surface area of the originally selected large body of the same weight.

We are now ready to apply these mathematical considerations to practice use. Increase in the surface area makes itself mostly noticeable in the selection of smaller particles of admixed substances, when the mixtures are made in accordance by weight. For then exactly the same weight must be present in the small particles as in the large particles if the latter are employed in making the mixture. The conditions are somewhat more favorable when the mixtures are made in accordance with volumetric proportions. This is due to the greater intermediate space between the individual particles.

This fact becomes very clear to us, when we consider a silica or sand of one cubic centimeter volume, which has no intermediate space between the particles and one cubic centimeter of fine sand in which there are certain intermediate spaces between the particles. Inasmuch as the intermediate spaces weigh nothing, then we will have a lesser weight of substance in the second case than in the compact silica, and hence not so great an increase in surface area as in the case where the total weight consists of sand only. In spite of this fact the increase in the surface is not small.

However there is also another disadvantageous condition, namely the aforementioned increase in the intermediate spaces, which must be filled with cement. Hence more cement is required, first in order to cover the surface area of the particles, and then for filling the spaces between the particles. A mixing ratio of one part by volume of cement to five parts by volume of sand was used in making the concrete posts and the used cement was not sufficient to give a good product. A porous concrete was obtained, which sucked up water. The water was quickly absorbed. Under such conditions it is impossible to expect any strength in the post, and naturally sufficient cement could also not have been present in order to fasten the cement to the iron bar reinforcement.

Posts were then made from ordinary cement and gravel and the cement was used in the same proportions as in the first case. These posts were absolutely solid after a period of six weeks and the cement had become so firmly attached to the iron bar reinforcement that it could not be removed therefrom by repeated hammering, the bars themselves being bent with the adhering cement. The fact that more cement was not employed in this case indicated that the difference must be due to the physical character of the gravel as compared with the sand used in the first case. Then tests were made with the same sand and supercement in the same ratio of one to five. The posts were absolutely satisfactory. In this case it must not be forgotten that not only is the supercement of

better quality than ordinary but also the fineness of the supercement is twice or three times that of ordinary cement, and hence it was able to completely cover all the particles of the fine sand, although the ordinary cement could not accomplish this.

It should also be mentioned that the outward appearance of the posts made with gravel and ordinary cement was perfectly satisfactory. A few pieces of gravel did show on the surface but this did not injure its smoothness. On the other hand if this is unsatisfactory it is necessary to use either supercement or ordinary cement, the latter in a higher proportion than indicated above. This is particularly necessary when making articles with thin walls.

In choosing a size of particle in the admixed substance in making concrete and cement mixtures, the essential point to remember is that the different particles should be present in such proportions that all the intervening spaces are filled up as far as possible. Then these spaces need not be filled with cement. The latter then acts essentially as a binding agent. It is evident that a concrete or cement mixture of this character will give a product which possesses a high degree of mechanical resistance just because there are few pores in it.

Fuller was the first to develop a curve, which is given in figure 2, on the size of particles in an

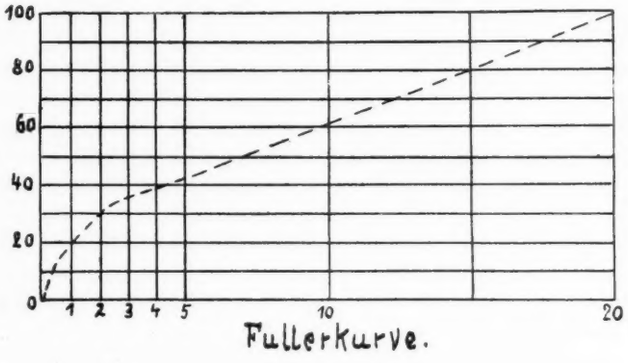


Figure Two

ideal cement mixture. It should be mentioned that the cement is of maximum fineness in this mixture. Hence the cement mixture must contain 30 per cent of particles 0 to 2 millimeters, 13 per cent particles 2 to 5 millimeters, 19 per cent particles 5 to 10 millimeters and 38 per cent particles 10 to 20 millimeters. The proportion of cement is twenty per cent. In order to determine the size of particles in the pebbly sand used in the mixture, it is necessary to substract twenty percent from the finest particles for the cement. Then the proportions of particles of various size in the pebbly sand is 10 per cent between 0 and 2 millimeters, 13 per cent between 2 and 5 millimeters, 19 per cent between 5 and 10 millimeters and 38 per cent between 10 and 20 millimeters. Converting these figures to a hundred per cent basis, we have a proportion of 12.5 per cent of particles 0 to 2 millimeters, 16.25 per cent from 2 to 5 millimeters, 23.75 per cent from 5 to 10 millimeters and 47.50 per cent between 10 and 20 millimeters.

The author has thought it advisable to spend some time in devising a method which can be used to determine the degree to which any cement mixture or concrete approaches in the proportions of various particle sizes the ideal proportions which have been set by Fuller. It is felt that this method will not only be interesting and valuable to the larger institutions which manufacture cement and cement products but also to the smaller establishments that are desirous of putting out cement products on the market that are as well made as possible.

Experience teaches that most gravels used in making cement mixtures contain too great a proportion of fines. Screening out the fines is always an uneconomical operation unless it is carried out in large installations. It may also happen that after the fines have been removed in this manner, more sand will accumulate on the plant than can be used. It is therefore recommended that a gravel be used that does not contain much sand, and then sand can thereafter be added separately if it is desirable. Such a sand-free gravel contains 1.0 per cent of particles of 0 to 1.2 millimeters size, 2.7 per cent between 1.2 and 4 millimeters

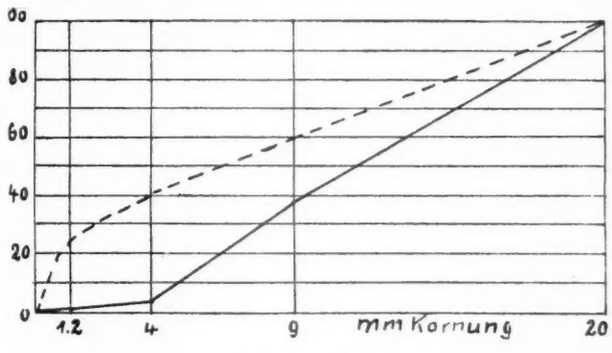


Figure Three

33.8 per cent between 4 and 9 millimeters and 6.25 per cent between 9 and 20 millimeters.

Figure 3 shows how close the curve for the sand free gravel runs in comparison with the Fuller ideal curve. The only problem that remains is to admix the requisite amount of fine sand with the gravel. In carrying out the screening test it is necessary merely to have a screen with holes of four to five millimeters, inasmuch as fine sand will leave only a slight residue on this screen. The analysis, given above, may then be expressed in simple terms as K_1 (from zero to four millimeters) 3.7 per cent and K_2 (from four to twenty millimeters) 96.3 per cent, making a total of 100 per cent.

In this case K_1 is so small that it may be neg-

lected without any trouble, inasmuch as a small excess of fines makes sure a smooth surface on the concrete. The composition of the two ingredients of the mixture is then very simple. At a mixing ratio of one to four the proportion in the cement is twenty per cent. Hence eighty per cent remains for the other ingredients. According to the Fuller curve thirty-nine per cent of the particles are of zero to four millimeters in size of which twenty per cent must be deducted for the cement itself. The remainder is therefore nineteen per cent. The mixed pebbly sand should then have the following composition: between zero and four millimeters 19 parts and from four to twenty millimeters 61 parts, making a total of eighty parts. When this is converted to the percentage basis, the figures become 24 and 76 per cent, respectively. This means that the ingredients must simply be mixed in these proportions. Thus 24 per cent of fine sand and 76 per cent of gravel. The finished concrete will then have the following composition:

$$24 + \frac{3.7 \times 76}{100} = 26.8 \text{ per cent of the fine particles and } \frac{96.3 \times 76}{100} = 73.2 \text{ per cent of the coarse particles.}$$

This corresponds approximately to the given composition of twenty-four and seventy-six per cent. The difference is due to the disregard of 3.7 per cent of fines contained in the gravel. The accuracy of the method is however satisfactory for practical purposes.

In the case of cement products which are made with thin walls and also in the case where the gravel contains a larger proportion of fines than four per cent, the calculation must be carried out with a greater degree of accuracy. It then becomes quite complicated. In order to show just how this calculation is carried out the following example is given.

Let x equal the quantity of gravel required in the mixture, y the quantity of sand required, k_1 the fines in the gravel, k_2 the coarse particles in the gravel, c_1 the fines in the sand and c_2, the coarse particles in the sand, f_1 the fines in the ideal gravel (according to Fuller) and f_2 the proportion of coarse particles in an ideal gravel (according to Fuller). Then the two following equations may be written, each containing two unknown quantities:

I. $k_1x + c_1y = f_1$. II. $k_2x + c_2y = f_2$.

The values for the fine and coarse particles in the various ingredients of the mixture are given below as used in the calculations up to this point. Thus for gravel, the value of k_1 is 3.7 per cent, k_2 96.3 per cent, for sand c_1 100 per cent and c_2 zero per cent, and for an ideal gravel f_1 24 per cent and f_2 76 per cent. The unknown quantities then remain x and y.

The aforementioned figures are now introduced into the two equations, thus: I. $3.7x + 100y = 24$. II. $96.3x + 0y = 76$. From the second equation we obtain $x = \frac{76}{96.3}$ or 0.79. Setting this value of x in equation I we obtain $3.7 \times 0.79 + 100y = 24$ or $y = \frac{24 - 3.7 \times 0.79}{100}$ or 0.21.

Hence one part of the cement mixture will then contain 0.79 parts of gravel and 0.21 parts of fine sand. The general rule in practice is to mix one part of the sand to four parts of the gravel. Then the size of the particles in the mixture will be as follows:

Fine particles 3.7×79	21.0 per cent fine sand
	2.9 per cent gravel
	23.9 per cent
Coarse particles $\frac{96.3 \times 79}{100} =$	76.1 per cent
	100 per cent

It is thus evident that the composition of the mixture corresponds to the ideal gravel.

Just to what extent the use of coarse ingredients and thorough filling of the intermediate spaces by suitable composition of the ingredients as far as particle size is concerned can improve the strength of the product can be told from a comparison of the strength figures for two extreme cases, namely a mixture which contains fine sand only and one which contains an ideal gravel. According to the Fuller curve a mixture made of one part by weight of cement and five parts by weight of gravel and containing the following particle size proportions is compared with the Fuller curve in figure 4. The mixture contains 16.7 per cent of cement, 9.3 per cent of particles 0 to 1.2 millimeters, 11.5 per cent of particles of 1.2 to 4 millimeters, 9.5 per cent of particles of 4 to 9 millimeters, and 53 per cent of particles whose size varies from nine to twenty millimeters in diameter.

It is clear from the comparison of these results with the ideal Fuller curve as given above in figure 4 that there are too many large particles in the cement mixture. This is of course brought about by an error in figuring the composition of the mixture. In spite of this fact, the object which was made with the aid of this cement mixture and which had the dimensions of twenty centimeters wide by twenty centimeters high had a surface which was absolutely smooth. Furthermore, the concrete form could be easily removed from the boards that held it while the cement was still soft.

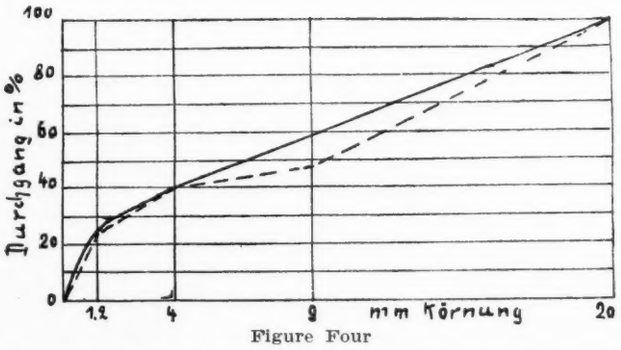


Figure Four

However when the cement mixture was made with the aid of fine sand, it was found that the removal of the object from the form was a difficult matter and the only way in which it could be done without great trouble was to use an iron form which had previously been well oiled. It was found that when such a form was not used large clusters of the cement mixture remained hanging to the walls of the form. This is a phenomenon which is often encountered in practice.

The following tabulation gives the results of the testing that was carried out on the various cement mixtures and the products obtained with them.

No.	Age in days	Composition	% water added	Total pressure on object kg.	Compressive strength in kg. per sq. centimeter
1.	28	one part cement five parts fine sand	10	67,670	169
				67,670	169
2.	28	one part of cement five parts ideal gravel	7	143,145	358
				146,915	367
3.	28	one part supercement five parts fine sand	10	78,985	197
				75,215	188
4.	28	one part of supercement five parts of ideal gravel	7	188,430	471
				188,430	471

It is easy to see from these figures that the use of a pebbly sand with the correct proportion of particle size introduces very great advantages. In making small objects from cement mixture it is possible to use mixtures of finer particle size and still obtain a satisfactory degree of mechanical resistance.

Incomes Analyzed

Statistics recently announced by the Government show that 4,171,051 individuals earned $25,272,000,000 in income which was reported to the United States treasury for tax purposes in 1926. Wages and salaries represented 38 per cent of the full amount and totaled $9,742,000,000. Men and women engaged in business directly either as owners and proprietors or partners received income totaling $5,516,000,000. This item represented 22 per cent of the total income.

Incomes received in the form of dividends also amounted to 22 per cent of the whole and was reported as $5,610,000,000. Profits from the sale of real estate and other property produced income amounting to $2,932,000,000 or 12 per cent. Rents and royalties totaled $1,472,000,000 or 6 per cent of the whole income reported.

Second Austrian Good Roads Conference

Austria held its second "good roads" conference in Vienna, June 15-18, under the patronage of the Federal ministry of commerce and transportation. The meetings were attended by about 400 members of the Good Roads Association. Engineers from various cities and towns through the country and a number from Hungary and Jugoslavia also took part, both in the meetings and in the actual inspection of road construction work.

The first two days were devoted to a general discussion regarding the need for better roads in Austria, the various kinds of materials available in Austria for road building, the advantages of different methods of road construction, plans for connecting up in a more comprehensive manner existing hard-surface highways, and methods of financing an extensive road-construction program. June 17 and 18 were devoted to inspection of actual road repair and construction work going on in Vienna and nearby places—Wiener Neustadt, Baden, and Semmering.

About 300 men and a dozen women took part in this road inspection, some thirty motor busses and motor cars being chartered to provide transportation for the party. The inspection of the roads was very thorough. Some fourteen different methods of road construction in actual operation were carefully examined, and the merits and demerits of each explained in detail. Within the city limits, brick, stone, wooden blocks, and asphalt repair work were examined. The construction and repair work found on the highways, with the exception of one sand-cement construction, were all on the tar-macadam principle—rock, gravel, bitumen, and sand. Their differences consisted in the different quantities of materials used and in the methods of applying them. The machinery used was chiefly Austrian and British. The Austrian steam rollers were all quite small and appeared to be in every way inferior to the British machines. The only American machine noticed on the entire inspection tour was one for driving paving stones snugly into place by means of a perpendicular hammer suspended in a steel frame, power being supplied by a gasoline motor.

As a whole the inspection trip was believed by all to be thoroughly worth while and intensely interesting.

LIMESTONE FACTOR IN FLORIDA PHENOMENON

DOWN in Florida, many years ago, the Seminole Indian women used crude corn grinders made of Florida limestone in order to prepare meals for their families. These grinders were nothing more than limestone boulders about the size of a prize pumpkin and had a concave place at the top. The corn was placed in this hollow and cracked or ground with a rounded stone pestle. But all that was years ago. Today the Seminoles are nearly gone. Only a few remain. The camps which used to dot the shores of placid lakes and streams have vanished. Likewise some of the old outcroppings of limestone show evidence of stone being removed in places years ago. This is particularly true around Ocala, now the Lime Rock Center of Florida.

Near Ocala is Silver Springs, a spring which is famous for its remarkably clear water. The water is so clear that many underwater pictures have been made with ordinary cameras. The objects on the bottom are seen through a depth of water at a distance of 60 feet in places, as visibly as though they were in the open air. The view is wonderful due to the multi-color effects on the vari-colored grasses and flowers.

Silver Springs is really a river. It is crystal clear—clear as air for nine miles, where it flows into the coffee colored Ocklawaha river. This remarkable clearness should be interesting to everyone, but more so to the lime manufacturers and the water softening and purifying equipment manufacturers, because Silver Springs is a naturally purified body of water and the largest flowing spring in the world. The orifice is twelve feet in height and sixty-five feet in width. Large enough to shelter six large freight box cars. The flow according to the Florida Geological Survey is 22,134,-780 gallons per hour.

Apparently this enormous volume of water is filtered through a vast area of high calcium limestone. For practically all of Marion County is underlaid with limestone of the same uniform analysis. When the water finally finds its way to escape through the underground confinement it has been purified by nature. This forms a delightful body of water, very pure, and clear. It is a favorite resort for the people of Florida. Also thousands of visitors view the wonders of the springs every year in special boats with glass panels in the bottom. They view the remarkable sights and emerge from the boats feeling as though they had been on a visit to an unexplored world for half an hour. But few of them pause to question why the extreme clearness of the water exists. Lime manufacturers of course know that the natural limestone filter has been doing the purifying of water for years, thus explaining the phenomenon. All lime and limestone manufacturers will find Ocala and Silver Springs an interesting place to visit when in Florida, for near Silver Springs and Ocala are a number of modern crushed stone and hydrating lime plants.

Present Status of Highways

According to an announcement by the United States Bureau of Public Roads, approximately 163,057 miles of rural highways have now been improved and surfaced in the United States by the 48 state road departments and about 20,000 additional miles are being constructed this summer. Most of the highways surfaced by the states are interstate routes, and together they form a means of traveling in comfort to virtually every section of the country.

Twenty-three per cent of the system is surfaced with concrete and consists of 36,750 miles. Macadam surface includes 31,355 miles of the total, about 19 per cent. Brick, asphalt, and miscellaneous varieties of hard covering have been used for surfacing 4,270 miles. Dirt and gravel form the covering on 90,682 miles of highway or about 55 per cent of the total. Although not as hard a surface as the others, this type of road is listed as improved because it is constructed with regard to road engineering principles and drainage is provided.

Tax Free Securities Gaining

The income from funds totaling approximately $15,348,000,000 is now escaping taxation in the United States, according to an estimate made by the U. S. Treasury. The Treasury department officials, headed by Secretary Mellon, have repeatedly urged action by Congress and the states that will prevent the further issuance of tax-exempt government obligations. The Federal Government long ago ceased to offer such securities. The state and local governmental agencies, however, are selling tax-free securities in constantly increasing volume. The net amount of tax-free securities outstanding is now nearly four times what it was in 1913. The net amount outstanding represents the total volume of such securities less sinking funds and securities held by the U. S. Government.

In 1913 approximately $4,410,000 represented the net amount of outstanding tax-exempt securities. During the next four years the total rose to over five billions. It passed the seven billion figure in 1919, reached eight billions in 1921, jumped to more than eleven billions in 1923 and then rose swiftly to thirteen and fifteen billions. It is likely that by 1928 tax-free securities will exceed sixteen billions.

SHERMAN SAND AND GRAVEL FINDS PROFIT IN DEVELOPING HOME MARKETS

By F. A. Westbrook

EVERY once in a while some new angle seems to come to light in almost every line of business no matter how well established and standardized it may be as a whole. Some enterprising owner or manager is sure every so often to find a new market for his product. Or he may be keen enough to see an opening for a new product in his home market and then be progressive enough to develop it.

Now the sand and gravel business is a pretty well standardized proposition, at least so far as the uses of products are concerned. The building trades, highway construction, and a few other well-known activities absorb practically the whole output. Nevertheless the Sherman Sand and Gravel Company, of New Britain, Connecticut, has developed an important outlet for a good part of its output which as a result of a few simple operations, not carried on in plants of this type, enable it to make a nice profit. It is due to the fact that New Britain is the largest manufacturer of hardware in the country. The hardware manufacturers, including such well known concerns as Pratt and Whitney, P. F. Corbin, the Stanley works and many others, do a great deal of sand-blast work and it is the production in quantity of the proper grade of sand for this purpose which distinguishes this company. The only additional machinery required especially for this purpose is a rotary drier, an elevator and a vibrating screen. This will be described in detail later.

In fact the company as a whole has marketed individuality in several respects. It has two sand pits in Plainville and two in Farmington. Its screening and washing plant, as well as its distributing yard are in the city of New Britain. The sand as it is taken from the bank is loaded into trucks by the shovels and transported to New Britain. The distances are not far and evidently the questions of water supply and the obvious advantage of avoiding duplications of machinery at each pit make this procedure good business under the conditions found here.

There is at present a fleet of twelve trucks, nine Macks equipped with Wood hydraulic hoists and three Whites equipped with Wood underbody hoists, for bringing in raw materials from the pits and for making deliveries to consumers. Raw material is dumped by the trucks over a grizzly to remove cobble stones. There are actually so few of these and they are of such small size that they are picked up by hand and thrown into the crusher.

The great bulk of the material passes the grizzly and is taken by a Good Roads elevator to the two

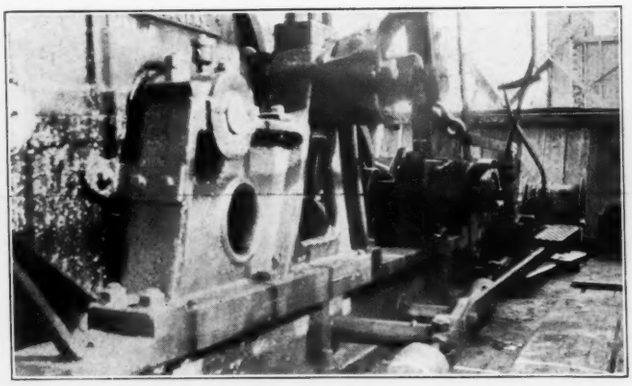
View from Top of Screen House, showing Derrick, Stock Sand Pile and Garage

Truck Unloading at Grizzly

conical washing screens made by the same company. The gravel goes direct into bins and the sand and water into home-made settling tanks and then into bins. The oversized material from the screen descends through a chute to a small Champion jaw crusher which discharges into a small bucket elevator which returns the crushed oversizes to the hopper under the grizzly. The maximum production is about 500 yards per day.

Of course the question of water supply is important. As already stated this plant is in New Britain. As a matter of fact it is practically in the center of a city block and surrounded with houses. City water is the only possible source of

Derrick With Sand Pile in Foreground



Eectric Hoisting Engine

Concrete Settling Pond

supply and naturally every reasonable means has been taken to use as little as possible. A concrete well in two sections has, therefore, been built. The overflow from the settling tanks runs into the larger section which acts as a settling tank for mud and overflows into the smaller section where the suction pipe from the centrifugal pump is located. The pump thus draws its supply both from the city main and the well. In order to reduce the loss of water as much as possible the drippings from the storage bins are ditched back to the same well.

The amount of gravel in the raw material is not large and there is seldom an accumulation beyond the capacity of the bins. This is not true of the sand, however. It is in such large proportion that it accumulates and must be stored at times. The

Derrick Removing Mud from Settling Pond

Moto-Vibro Screen for Grading Sand

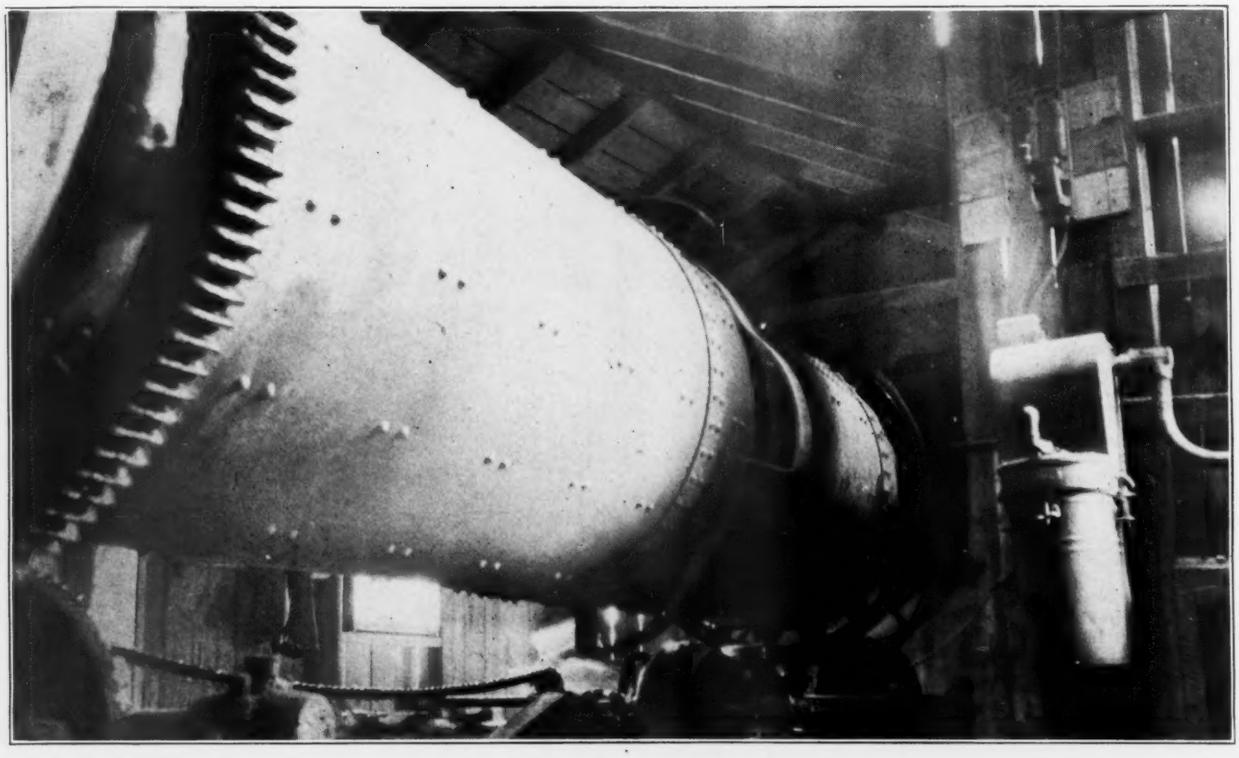
method of disposal is simple. The bins, which are primarily arranged for the loading of trucks, are provided with spouts so that their contents may be dumped on the ground in the open. An American derrick, with a Lidgerwood electric hoist, Hayward one yard bucket, and plough steel cables picks up the material and places it in piles. Of course this may be done with either sand or gravel but it is seldom necessary with the latter.

The uses to which this derrick is put are varied. It loads trucks from the storage piles. It also picks the mud out of the pump-well every night and places it in a pile by itself. This is very important, not only in the scheme of water economy but also because there is a ready market for the mud for fills where real estate improvements are going on. In fact the sale of the mud is said to pay approximately the cost of trucking between pit and plant. Another important duty performed by the derrick relates to the production of sand suitable for sand blasting. The machinery for this is in a separate building and the first operation consists of drying in a Ruggles Coles cylindrical dryer. A hopper has been placed over the end of this. The hopper is within reach of the derrick and is filled by it from the outside sand storage piles.

After the sand has passed through the hopper it is discharged into a pit from which it is taken in a small chain and bucket elevator to a Sturtevant vertical elevator. This method of transfer from the dryer tends to cool the sand somewhat although Mr. Wheelock, the superintendent, says, it is still "great stuff to warm your feet in on a cold day." The Sturtevant elevator takes the dry sand to the top of the building where it discharges into a Tyler vibrating screen. Four sizes are produced here. Number one size is very fine and practically useless. Numbers two and three are in great demand by the hardware manufacturers already mentioned as well as by those who clean the facades of buildings by the sand blast methods in Waterbury and Hartford, Connecticut and can hardly be produced in sufficient quantities. Number 4 is a small roofing gravel and has a ready market. These four sizes are deposited in separate bins under which trucks may be loaded. The production at this point is about 50 yards per day. Practically all of the material is sold in New Britain or the immediate vicinity so that the central location of the plant is a great convenience.

Provincial Control of Quebec Highways

The last session of the Quebec Legislature passed a law authorizing the transfer to provincial control by the municipalities of certain sections of improved roads maintained by the latter. According to the minister of roads for the Province, the transfer is now 97 per cent complete. Before the year is ended it is believed that 100 per cent of the improved highways will be under provincial control. In 1923 the provincial government maintained 13 per cent of the improved roads; in 1924, about 42 per cent; in 1925, about 49 per cent; and in 1926, about 59 per cent. The length of improved highways in the Province on December 1, 1926, was about 7,560 miles.



Rotary Dryer. Note Controller at Right

ACTION OF CALCIUM CHLORIDE ON CEMENTS

By M. Anstett

USE of solutions of calcium chloride of varying concentration has been one of the most advisable and most highly recommended methods that have been devised for the protection of hydraulic mortars and cements against the action of low temperatures. Hence it is not surprising to find that a great number of experimenters has studied this problem from the standpoint of the action of the solution of calcium chloride on the hydraulic binders. Unfortunately the results which have been obtained along these lines have been discordant at times. Nevertheless the following facts seem to have been established in a satisfactory manner and no disagreement exists regarding them.

When portland cement is mixed with a dilute solution of calcium chloride, containing just a few grams of the salt per liter of solution, then the cement will set more slowly than if pure water had been used in making the mixture. But if a concentrated solution of calcium chloride, containing as high as one hundred to four hundred grams per liter, is used in making the mixture, then the setting of the portland cement is accelerated to a marked degree.

The solution of calcium chloride may then well act as a stabilizer of the cement mortars. It does in fact induce the rapid slaking of the quicklime which may be found in portland cements in greater or lesser proportions. This slaking of the quicklime content of the portland cement, which takes place only at a very slow rate of speed when pure water is used in making the cement mixture, is then able to cause the swelling and disintegration of the mortars. Such action is avoided by the use of a solution of calcium chloride.

Fresh cement, which has been mixed with a solution of calcium chloride, will acquire a considerable mechanical resistance within a short period of time. Hence this process may be used in sealing holes and the like by mixing the mortar so that it is quite thin and using this mixture only at the moment that setting is ready to occur, which is recognized by the marked increase in the temperature of the mixture as well as by an increase in its consistency.

A mortar which is mixed with a concentrated solution of calcium chloride will disintegrate if it is submerged in water for a few moments before setting sets in. On the other hand, if the mixture is kept for fifteen to twenty hours in the air and then submerged, it will retain its hardness indefinitely. The fact that renders these experiments difficult to carry out is that the results will differ according to whether fresh cement is used for making the mixtures, or a cement which has been exposed to the air for some time. In the first case accelerated setting of the cement is obtained, while in the second case, the acceleration is nil and the final mechanical resistance of the set and hardened article is diminished.

It is easy to see how these phenomena, as they take place above, can become very complex, for the reason that the results that are obtained depend on the concentration of the solutions in the first place, then on the time over which the cements have been in storage before being employed. Then again there are other factors which govern the results that are obtained with the various cement mixtures, these factors exerting their action entirely independently of those that have first been mentioned. These factors are the temperature at the moment that the cement is mixed with the calcium chloride solution, etc., the proportion of liquid that is used, the manner in which the samples are stored while awaiting testing, and others. All these conditions and factors deserve to be carefully studied. The experiments should be carried out in a systematic manner, but in order to obtain complete and conclusive results, it is evident that a large number of experiments will have to be made.

In this article the author will simply avail himself of an opportunity of describing a series of experiments which he made while using a compound which is known in commerce as X. The chemical analysis of this product established the fact that it was nothing more than a solution of calcium chloride, containing 382 grams of the salt per liter of the solution, its density at a temperature of 15 degrees C. being 1.288. The experiments that were made on this substance were for the purpose of studying the following points. First, the effect of the solution of calcium chloride on cracking was studied, then the efflorescence of the mixed mortars, then the effect on the duration of the setting, fourth, the effect on the hardening of the cement mixture carried out at a normal temperature and fifth, the influence of the solution of calcium chloride on the hardening of the cement mixture at low temperatures.

Eighteen flat discs were made with a pure cement mixture or paste, these discs being quite thin. Nine of these cement mixtures were made with the addition of pure water and nine with the addition of a mixture which consisted of one portion of water and two portions of the commercial product known as X. These discs were then kept in water at a temperature of 15 degrees C. Three of the discs which had been made with the aid of pure water showed cracks at the end of a few days, while the nine discs which had been made with the aid of the calcium chloride solution re-

mained intact at the end of several days. The results that were obtained from this experiment tends to lead to the conclusion that the use of calcium chloride solution in making cement mixtures aids in avoiding the formation of cracks in cement products.

Several tiles, which were made with cement mixtures containing various concentrations of solutions of calcium chloride, did not show any signs of efflorescence at the end of several weeks. On the contrary the tile which contained the largest proportion of calcium chloride was maintained in a state of constant wetness, which is not a surprising matter, inasmuch as the salt, calcium chloride, is known to be eminently deliquescent. Various tests were made to determine the effect of the calcium chloride solutions on the setting of the cement. These tests, as well as those which follow, were carried out on four different kinds of cement, namely, cement fondu, Holderbank cement, standard Portland cement, and slag cement. The following tabulation gives the results that were obtained in this series of experiments. The duration of the setting is given in the tabulation for the various cements, the conditions of setting being subjection of the cement to the air at an average temperature of 16 degrees C.

	Cement mixed with pure water		Cement mixed with 2 parts of water and one part of X..		Cement mixed with one part of water and two parts of X..	
	Beginning	End	Begining	End	Beginning	End
Cement fondu...	4 hr. 10 min.	6 hr. 40 min.	20 min.	1 hr. 5 min.	12 min.	35 min.
Holderbank	3 hr.	6 hr. 45 min.	16 min.	1 hr. 20 min.	4 min.	11 min.
Formal cement..	3 hr. 10 min.	6 hr. 45 min.	15 min.	2 hr. 30 min.	4 min.	17 min
Slag cement	5 hr. 15 min.	19 hrs.	3 hr. 45 min.	3 hr. 45 min.	1 hr. 45 min.	6 hr. 15 min.

The following conclusions can now be drawn from these experiments.

The addition of the solution of calcium chloride to the cement mixture accelerates the setting of all sorts of cements, but this acceleration, which is quite marked in the case of the first three cements, shown in the above tabulation, is considerably reduced in the case of the slag cement. In the second place the use of concentrated solutions of calcium chloride is not recommended for the Holderbank and Portland cements, whose setting takes place within the very short period of four minutes under these conditions, which makes the use of such mixtures unsuitable for practical purposes. It was next necessary to investigate the effect of the calcium chloride on the hardening of the cement mixtures. The results that were obtained in this series of experiments is given in the following tabulation:

The addition of a concentrated solution of calcium chloride to the cement mixture has a clearly unfavorable effect on slag cement, an unfavorable effect but not to so marked a degree on cement fondu, a doubtful effect on Holderbank cements and a favorable effect on Portland cement, particularly at the end of two days, and the least effect after the end of seven days. But the mortars that were exposed to a temperature of 20 degrees C. all gave remarkably high mechanical resistances, while when they were made with the addition of pure water, their resistance was almost nil, which agrees with the results that were obtained in former experiments.

The use of calcium chloride may, therefore, be held to be of very great importance in the preparation of mortars during the cold months of the year. However, the action of calcium chloride on the hydraulic binding agents is not well or completely understood, for a number of complicated phenomena ensue. It appears that it is most advisable to make a preliminary test on the materials which are going to be used in making the mortar before mixing large amounts of the cement and other ingredients with calcium chloride. It is only when such preliminary investigations are made that it is possible to advise the use of the calcium chloride solution in making mortars which will be used in constructing large structures. This is, after all, the safest way in which to proceed.

Resistance of Cement Mortars to Compression. Mortars mixed with one third water into plastic paste. Test samples were kept in water at 15 degrees C.

	Mortars made with pure water		Mortars mixed with two parts of X and one part of water		Samples kept at 20 degrees C. Mortars mixed with 2 parts X of and one part of water	
	2 Days	7 Days	2 Days	7 Days	2 Days	7 Days
Cement fondu ...	336 kg.	328. kg.	168 kg.	169.3 kg.	122.7 kg.	177.3 kg.
Holderbank	63.3 kg.	196 kg.	166.7 kg.	178.7 kg.	96 kg.	216 kg.
Normal Portland.	23.9 kg.	108 kg.	76 kg.	127.3 kg.	50 kg.	94 kg.
Slag cement ...	18.8 kg.	59.3 kg.	2 kg.	11.9 kg.	2.1 kg.	58.6 kg.

Definite, Continuous and Consistent Improvement in Pit and Quarry

R. F. Rucker, superintendent, Aluminum Ore Company, writes: "We find that Pit and Quarry has definitely improved since its first issue, continuously and consistently, and particularly since you changed the size of the periodical and added more technical articles. We are thoroughly pleased with the policy and character of your journal and we can only compliment you on its progress and valuable character."

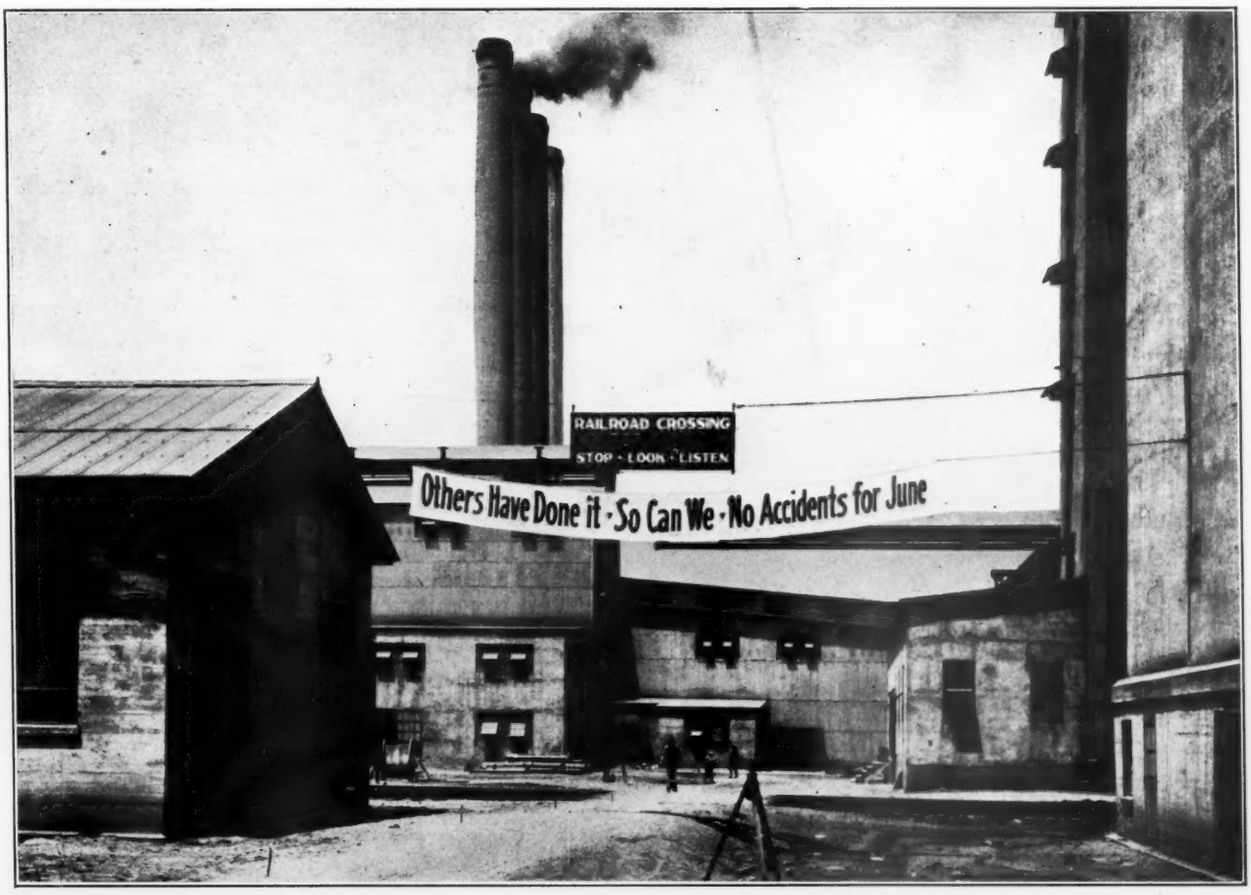
CEMENT INDUSTRY SETS SAFETY RECORD

NINE years ago, a thorough system of no accident work was started by the bureau of accident prevention and insurance of the Portland Cement Association. This year's no-accident campaign is under the direction of A. J. R. Curtis, safety engineer. Under this system every mill embraced in the organization reports in detail every accident, and the material thus gathered is carefully tabulated as a basis for intensive study and research. The facts and figures thus assembled show that 95 per cent of all accidents are due to carelessness or lack of knowledge. The purpose of the association's no-accident campaign, therefore, is to eliminate these causes by education and by arousing enthusiastic interest in the subject of accident prevention.

The final report for the month of June, 1927, shows most gratifying results, there having been fewer accidents than any comparable month since the association report system was inaugurated. As compared with the same month in 1926, lost time accidents were reduced by 75 per cent, there being only 50 such as compared with 192 last year. There was only one fatality as compared with six in 1926. These figures are even more striking when it is considered that more men were employed and more plants in operation in June, 1927, than in the same month last year.

Memorial Trophy to be Presented to the Mill or Quarry that Goes Through 1927 Without a Lost Time Accident

One hundred and thirty-five safety banners out of the 164 hoisted on the plant flag poles June 1 are still flying. These flags were presented to the



These Two Safety Signs Help This Birmingham Plant

This Safety Banner Over a Mill or Quarry Proclaims a Clear Lost Time Accident Record

plants by the Portland Cement Association with the understanding that they are to fly as long as no lost time accidents occurred. In case of an accident the mill flag is sent back to the association with an explanation of the mishap that caused its loss. Only 29 mills and quarries lost their flags during the entire thirty day period.

Of the mills which suffered one or more accidents it may be said on comparison with their recent records that with only two or three exceptions the June, 1927, reports show noteworthy gains. Nineteen mills sustained one lost-time accident each during the month; four had two lost-time accidents each, and seven had three or more.

Statistics just completed for the first six months of 1927 show that 27 plants in the membership of the Portland Cement Association have succeeded in coming through this entire period without lost-time accidents. These plants now constitute the Trophy Club, whose slogan is, "Meet me in New York," and are all in line as potential winners of the association trophy for 1927. The list is as follows: Alpha Portland Cement Company, plants at Martin's Creek (No. 3), Pennsylvania, and Ironton, Ohio. Bessemer Lime and Cement Company, Youngstown, Ohio. Canada Cement Company, Ltd., plants at Hull, Quebec, and Belleville, Ontario. Cowell Portland Cement Company, Cowell, California. Crescent Portland Cement Company, Wampum, Pennsylvania. Diamond Portland Ce-

Results For June of 1926 and 1927 Compared

A Forceful Sign

ment Company, Middle Branch, Ohio. Kansas Portland Cement Company, Bonner Springs, Kansas. Lehigh Portland Cement Company, plants at Bath, Pennsylvania; Iola, Kansas; Mitchell (No. 2), Pennsylvania; New Castle (No. 3), Pennsylvania; Oglesby, Illinois; Ormand (No. 3), Pennsylvania, and Sandts Eddy, Pennsylvania. Louisville Portland Cement Company, Speed, Indiana. North American Cement Corporation, Security, Maryland. Pacific Portland Cement Company, Cement, California. San Antonio Portland Cement Company, San Antonio, Texas. Oregon Portland Cement Company, Lime, Oregon. Texas Portland Cement Company, Dallas, Texas. Universal Portland Cement Company, plants at Duluth, Minnesota, and Pittsburgh, Pennsylvania. Virginia Portland Cement Corporation, Norfolk, Virginia.

The annual meeting of the cement section of the national Safety Council will be held in connection with the National Safety Congress at Hotel Stevens, Chicago, on Tuesday, September 27, 1927. Following the usual custom, the general sessions of the section will begin at 9:30 a. m., continuing into the afternoon, with an intermission for luncheon. The annual cement section dinner, which will be held at 6:30 p. m., will take the form of a big safety rally with speakers of national reputation—and some snappy safety songs.

A program of unusual interest and benefit has been arranged. Some brand new ideas about safety work will be presented. A graphic study of progress in the safety work of the cement industry will be shown. The meeting will be a "pep" session from start to finish, calculated to send every superintendent, foreman, safety director and committeeman back home with new ideas and increased enthusiasm for safety work in 1928.

There will be a joint meeting with the quarry section on Tuesday afternoon and the regular quarry section meeting on Wednesday, September 28. A joint luncheon of the quarry, mining and cement sections will be held Wednesday noon—another rousing opportunity to replenish ideas and enthusiasm. Over 1,100 tickets have been sold

The Thought Behind This Kansas Plant Safety Sign is Valuable

already for the general safety dinner, Wednesday evening, which will be the high point of the Congress.

All meetings of the cement section will be held in Hotel Stevens, North Assembly Room, third floor, with 300 seats, providing room enough for everybody. Two hundred and fifty live safety boosters from cement mills and quarries all over America are expected to meet the members of the 1927 Trophy Club—27 members with perfect 1927 records at this writing.

Road Development in Sumatra

An important road development is in full progress throughout Sumatra. The Netherlands Indies government has appropriated millions of guilders for the improvement of existing roads and for the extension of entirely new roads into hitherto undeveloped areas. It is being realized more and more keenly by the government that the establishment of suitable road facilities is an important factor in the development of the island.

The cost of road construction in Sumatra is very high, owing to the mountainous character of much of the country and the numerous swift-flowing rivers. The road facilities now existing are remarkably good, considering the sparsely populated character of the island and the newness of its entire economic development.

HOW TEXAS DEPOSITS DORMANT FOR YEARS CAME TO BE DEVELOPED

ABOUT 1852, when Central Texas was infested with roving bands of Indians, the Wacos, Commanches and other tribes and at San Saba the Texas Ranges fought to keep back the incursions of the redmen, a group of hardy pioneers seeking a location found what was supposed at that time to be salt but later on the material proved to be nitrate of potash, (saltpeter) and thus was potash discovered in Texas. Twenty years later the great potash mines of Germany were opened and from that day in the early seventies of the last century, until now, the world has paid tribute to foreign potash.

But now Texas is to come into her own for along the foothills of a low lying range of mountains west of the Colorado River in San Saba County, Texas, there is a vast deposit of potash bearing rock which will soon supply the world with cheap and efficient fertilizer. It would seem that Nature in her wisdom had foreseen the day when our bread and clothes would depend upon supplying to the soil the food values of which plant life was depleting it and in her providence had, almost in the geographical center of Texas bountifully supplied the fertilizer element necessary for successful agriculture which in greatest part had to be imported from other countries and so abundant is this contribution that it appears there are millions of tons easy of access, rich in potash, rich in nitrogen, rich in every element demanded and necessary for plant life and soil fertility.

From a study of the formation and the surrounding conditions it is believed that at one time, very probably before the Pleocene Age, as the waters receded to the south and east there was left a large inland sea covering possibly millions of acres and in course of time the waters of this sea slowly evaporated. The disintergration of the rocks and silt washing into this basin covered for ages the decayed animal life from the sea. Vegetation sprang up in the soil thus formed and it is very evident that plant life became abundant, and so when possibly at its best there was another submergence by the sea and the limestones which are large and deep bedded where this deposit is, were laid down.

Ages rolled by—the sea disappeared, the chemistry of nature wonderful, but not understandable, continued its processes where the inland sea had been and perhaps in pleistocene time when the granites and schists of Texas were forced up, much of the material of this great sea, evidently in places still plastic, were forced to the surface. This is doubtless very true, for in the presence of this an extrusive formation is found in many places and there are to be found in it fossils of both animal and vegetable origin. Several years ago the existance of this formation was brought to the atten-

View Showing Outcroppings in Deposit

tion of Judge T. F. Hawkins of Georgetown, Texas, who at once commenced a complete and exhaustive study of the extent and possibilities of the deposit. Conditions in this and many other countries were examined, the value of all known fertilizer material determined as far as possible and tests and analysis were made of the Texas potash material. Thousands of miles were traveled, scores of discussions held and much money expended. The one great thought in mind being to develop and deliver to the American farmer a good and cheap fertilizer at a price which would enable him to buy all that he needed and should have.

With this in mind the organization of the American Fertilizer and Chemical Works, Georgetown, Texas was completed, and the installation of air drills, crushers and other machinery at the mine was commenced. Hundreds of tons of the material have now been mined and as the reader gets the story, car loads are being rushed north, south, east and west to be applied to depleted and worn out lands. "What is needed," said Judge Hawkins, when seen recently, "is a good as well as a cheap fertilizer, which can be delivered to the American farmer at a price which will be about one-half of the present price that he must now pay. Nitrate of soda from South America and potash from Europe seem to be considered as two of the essentials of the fertilizer and so long as we import this material this condition of high prices for low fertilizer will exist. It seems to be one of the fundamentals of the fertilizer trade as it now exists, to sell the farmer from two hundred forty to three hundred pounds of available plant food in a ton, the rest being useless filler and inert matter. On all of this valueless material he, the farmer, must pay freight, cost of sacking, selling, etc. We are satisfied from

Incline Tramway to Plant

Another View Showing Part of Deposit

our own tests and from analysis and tests made by responsible chemists and fertilizer technicians, that the San Saba deposits contain all that is essential for the maintainence and upbuilding of premanent soil fertility. Our production cost will be very low because no deep drilling or excavation work is needed. What we have is a crusher job. Our work consists only in mining, pulverizing, grinding and sacking the material and it is ready to apply to the soil. We use no filler or other useless matter and the fertilizer is practically one hundred per cent available to the soil. Excessive charges of handling, commission to salesmen and like overhead will be eliminated as much as possible. It is the policy and intention of our company to sell to the farmer at the lowest possible cost and thus help him to lower the cost of crop production and in this way the entire nation will be benefited because we always have and always will have to depend on the filler of the soil for the ultimate good of all mankind."

The corporation is erecting its crushers and mills on the unit plan, and will use for material the marble and dolomite rock which abounds on the property and is practically unlimited. The service of the Texas Power and Light Company has recently been installed and traverses the entire length of the land to be operated and the company has contracted to supply power for a long term of years. Transportation facilities are very favorable. The Lometa branch of the Santa Fe railroad traverses at about a mile from the mines and trackage has been surveyed and will be laid in order to make direct connection to all parts of the United States. Orders are now on hand for car load lots of the new fertilizer and farmers and business men are showing considerable interest in what means a large saving in money and labor expended in crop production.

When one considers the fact that millions of tons of fertilizers are sold each year to the American farmer and that the cost to the farmer is an average of $30.00 per ton, it is plain to be seen that a cheap and available product of nearly one hundred per cent to the ton material will save millions of dollars to the planter and the nation. Production offices will be maintained at Georgetown, Texas and branches will be established at different points in the interior of the country and along the Atlantic seaboard.

The sixth National Exposition of Power and Mechanical Engineering will be held at the Grand Central Palace, New York, from December 5th to 10th, inclusive, and at the same time as the Exposition is held, the annual meetings of the American Society of Mechanical Engineers and American Society of Refrigerating Engineers, will also be held.

Where Material Handling Equipment Should Be Used

More, and still more efficient material handling equipment has been the order of the day with every forward looking industrial establishment for the past 25 years. Since 1910 discussions of mechanical methods for better co-ordinating production operations have invaded practically every industry. To summarize such discussions and indicate operations in particular, we point out a number of places where serious consideration of material handling equipment will usually reveal possible economies.

1—Where a man has to stand in one place, steadily moving materials, over thirty minutes at a time.

2—Where a man has to move materials continuously more than six feet of distance, or two steps.

3—Wherever a continuous stream of material has to pass from one operation to another.

4—Where continuous wrapping or packing operations are being carried on.

5—Where it becomes necessary to elevate quantities of material.

6—Where it becomes necessary to lower quantities of material.

7—Wherever it is necessary for men to lift loads continuously, regardless of weight.

8—Wherever material must be transported over a definite route at frequent intervals, but regardless of quantity, for a distance of 50 feet.

9—Wherever quantity production is desirable.

Once the above points have been fully considered it merely remains a question of machinery type—the kind best adapted for the work invoked. Ordinarily, material handling equipment is justified when it will pay for itself in savings during a period of five years or sooner.

Campaign To Cut Accident Toll

The American Road Builders' Association, in cooperation with the Hoover Conference on Street and Highway Safety and the National Safety Council, after several years of research into the causes and results of highway accidents which have killed 114,879 persons and injured 3,446,370 in the past five years, are planning a campaign to reduce this tremendous annual toll. The October campaign will be centered in a highway safety pledge card which will be distributed through schools, churches and various other agencies.

The ultimate objects of the campaign are five in number and include, first, education and regulation of pedestrian as well as motor vehicle traffic; second, adoption of a universal traffic code; third, education in safety; fourth, automobile inspection, and fifth, a comprehensive program of street widening and grade crossing elimination.

PROPERTIES OF HYDRATED LIME STUDIED

ACCORDING to an article by D. F. Richardson, appearing in a recent issue of Industrial and Engineering Chemistry, from which the following abstract is taken, the method of analysis of hydrated lime here outlined became essential to the study of the reactions taking place within the material and it was thus evolved.

The method described was first devised by E. E. Berger, formerly of the National Bureau of Standards, who did some of the preliminary work. It has further been developed and applied to hydrated limes by the author. As a preliminary phase of the investigation, time-temperature dissociation determinations were made on calcium and magnesium carbonates and hydroxides, with results which agreed very well with those of other investigators for calcium carbonate but were not at all comparable for magnesium carbonate and hydroxide and calcium hydroxide, probably because the range of dissociation temperatures of all three of these compounds overlaps and therefore in a mixture the results upon any one would be masked or compleely hidden by the behavior of another.

Development of Method

In working on the problem in question a method differing somewhat from that employed by the former investigators was used because of the peculiarities of the materials. The reactive nature of the various constituents of lime made it necessary to employ a closed system from which carbon dioxide and moisture could be excluded. For this purpose a tabulated platinum Gooch crucible was found to be excellently adapted. However, it was modified by sealing glass stopcocks, by which it could be closed, on both arms.

A great deal of trouble was encountered in obtaining a material for sealing the crucible which would make a gas-tight joint, withstand the temperature involved, and which would not absorb moisture from the atmosphere or otherwise change in weight during the run. After considerable experimental work, an enamel of the following composition was found to be satisfactory: Silica 15, lead oxide 45, sodium oxide 5, potassium oxide 15, and boric anhydride 20 per cent.

In the first runs the results are not at all satisfactory. However, after the aspirator was removed and a much more rapid stream of air from the compressed-air line of the laboratory forced through the gas-washing chain and the apparatus, very good results were obtained.

Method

The method found most successful is, in brief, as follows: The crucible is cleaned and dried, and the sample is weighed into it as accurately as possible. A sample of about one gram has been found satisfactory. The crucible is carefully sealed by fusing the enamel, of the composition already given, at the joint. Considerable care must be taken to refrain from heating the charge during this operation, and to avoid this the lower part of the crucible, in which the charge is contained, is kept immersed in water. After the seal has cooled the crucible is again weighed.

The furnace is raised to the desired temperature, the crucible inserted, and the furnace controls allowed to remain constant for 20 minutes. The temperature of the furnace naturally drops on the insertion of the cold crucible, and usually takes about 5 minutes to come to the desired figure, but the time is measured from the first insertion. Temperature measurements are made by means of a chromel-alumel thermocouple, on which the base of the crucible rests. The weight of the crucible is depended upon to maintain close contact between it and the couple. Temperatures are arbitrarily chosen, the intervals being usually widely separated at points where little dissociation is taking place, and very close at and near the points at which breaks in the curve are expected. A stream of dry carbon dioxide-free air is kept flowing through the system during this process.

At the end of the 20 minute heating period the crucible is removed, the stopcocks are closed, and the crucible is allowed to cool in a desiccator. When cool the pressure is equalized by allowing air to enter through the gas-washing chain, and the crucible is weighed. The furnace is raised to the next higher temperature, and the process is repeated.

This process may be criticised on the ground that the temperature intervals are not uniform, and that therefore the results, as plotted, mean little so far as the determination of a true temperature-loss in weight curve is concerned. This is true, but it is to be remembered that the primary purpose of this work was not to obtain such a curve, but to determine the properties of the dissociating constituents, and the method does give this information. The results check the theoretical figures quite closely, in most cases to within 1 or 2 per cent.

Application

After the method outlined above had been well checked, it was applied to a series of commercial hydrated limes high in magnesium. Magnesian hydrated limes, or as more commonly known, magnesian hydrates, from various sections of the country were obtained, with the idea of making the work as representative of all varieties of these materials as possible. Chemical analyses were made on all samples, and the free moisture was obtained by determining the loss in weight on drying in a carbon dioxide-free atmosphere at 110 degrees C.

Each sample was then subjected to a thermal analysis.

In order to determine to what extent the hydration proceeds in the overnight soaking in the form of putty, which the hydrate should receive before use, a sample of hydrate was soaked for 24 hours as a putty of about the consistency ordinarily employed, fired at 110 degrees C., and then subjected to a thermal analysis in the same manner as the others.

A comparison of the data with those from the same hydrate before soaking shows that a considerable amount of hydration does take place in soaking the material overnight. The percentage of magnesium oxide as hydroxide has increased to an appreciable extent and the percentage of CaO other than as carbonate or hydroxide has become practically negligible. Since, as in practice, no attempt was made to exclude carbon dioxide, its percentage has also increased to a considerable degree. This test is by no means conclusive, however. As the sample was dried at 110 degrees C., it is possible that the increased hydration may have taken place during this operation rather than during the 24 hours' soaking. Even with this treatment the magnesium oxide not present as hydrate amounted to more than 50 per cent of the total.

The small amount of magnesium oxide combined as hydroxide in the fresh samples justifies to some extent the theory which has long been held in practice, that the magnesia content of a lime does not hydrate at all. In the older samples, however, the higher percentage of hydroxide shows that this constituent does hydrate in time, and that probably with improved methods of burning and hydration a hydrate could be produced which would be completely hydrated at the start. In order to determine definitely the possible effect of unhydrated magnesium oxide on a mortar or plaster, further work is necessary.

Testing Materials Congress To Be Held at Amsterdam

The International Congress for Testing Materials at Amsterdam, September 12 until September 17, 1927, which is the first manifestation after the war of international cooperation on the subject of testing materials, promises to have the interest of the experts of many nations.

On the general meetings of the congress the following will read a paper: T. D. Lynch, East-Pittsburgh, Pa., "Materials Testing as a Stimulus to Research." A. Mesnager, Paris, "La Rupture des Solides." Prof. Korber, Dusseldorf, "Das Problem der Streckgrenze." Dr. Rosenhain, England, "Plastic Deformation and Fracture of Metals."

The subjects to be treated at the Congress are divided in three sections:

A. Metals.

B. Cement, concrete, stone and bricks.

C. Miscellaneous (oils, rubber, wood, etc.)

The papers will be read in English, French or German. Because of the limited time, the speeches will not be translated during the sessions.

During the Congress a boat trip will be arranged to the new sealocks under construction at the harbor of Ymuiden. At the end of the Congress an official banquet at Scheveningen near The Hague will take place. The meetings of the Congress will be held at the University of Amsterdam. On the days of the meeting a ladies' committee will arrange trips for the lady participants (Ryksmuseum, Volendam and Marken, etc.). During the Congress an exhibition of materials of the Dutch Colonies will be held at the Royal Colonial Institute at Amsterdam.

Status of Building Construction

The unusual construction activity in 1926 and the larger activity thus far this year have brought forward the problem of the status of building activity. The United States Labor Department has supplied data on this subject by a study comparing the volume of new construction with the increase in population from 1914 to 1926. The study deals with building permits issued in all principal cities of the United States.

In 1915 the amount of new building showed an increase of 2 per cent over 1914. The population increased in the same proportion. In 1916 building increased 14 per cent and population 4 per cent. During the next five years building fell off sharply, while population continued to gain. It was during this period that the nation-wide housing shortage began to develop. In 1922, however, the volume of building again began to increase faster than population, and this is a situation that has continued until the present time.

New Record for Gas Consumption Being Made This Year

A new record for consumption of gasoline is being made in the United States this year. Approximately 30,198,000 gallons of gasoline were consumed daily in the first six months of the year according to data collected from refiners by the United States Commerce Department. The report deals with the daily consumption rate in barrel units from January 1st to June 1st. Demand during June and July is believed to have been at the same rate.

Consumption averaged 719,000 barrels daily during the first five months of the year as compared with a rate of 647,000 barrels used last year. A barrel holds about forty-two gallons. The increase is slightly more than 11 per cent. The 1926 consumption rate exceeded that of the previous year by about nineteen per cent. Motor cars in operation in the United States this year number approximately 22,000,000 vehicles of all varieties.

CRUSHERS AND THEIR COMPONENT PARTS

By William T. W. Miller

Part V

PARTS one to four, inclusive, of this series of twelve articles have appeared in the past four numbers of Pit and Quarry. In these four installments Mr. Miller has discussed mechanisms applied to jaw crushers, jaws and check plates for rock crushers, toggles and toggle bearings and lubrication. In the fifth article which begins below he discusses the development of gyratory crushers. The seven future articles will appear in the ensuing seven issues of Pit and Quarry.

Mr. Miller, the author of this series, has had thirty years' experience as a specialist in crushing machinery. For the last twenty-six years he has been employed by Hadfields, Ltd., of Sheffield, England. For the past eighteen years he has been engineer in charge of their crushing machinery department. He has studied crushing problems in the United States, Canada, Brazil, Uruguay, Argentine, France, Spain and Portugal.—*Editor.*

Development of the Gyratory

It is not always easy to trace the origin of some of the machines which are in common use today. Frequently they are adaptations of some simple mechanism which emanated from the brain of a pre-historic engineer and which proved to be so effective that it survived the test of time. They may be modified in details but the essentials remain the same as when constructed with primitive tools and from the rude materials which were available to the original inventor.

Who, among the engineers of this planet, was the first to change from the principle of rotating the crushing cone as in a coffee-mill to that of gyration without rotation of the head, it is hard to say with certainty. Richards in his "Ore Dressing" mentions James W. Rutter of St. Louis, Missouri, as a likely claimant for the honor and his patent of 1869 may be taken as the starting point for a brief history of the development of the modern gyratory crusher.

"Rutters Ore Crusher," shown in Fig. 1, consisted of a cone attached to a square shaft working inside an open cylinder with a ball-and-socket joint supporting the upper end of the shaft and an eccentric wheel rotating in the baseplate for oscillating or gyrating the spindle carrying the crushing head in a conical orbit about the true axis of the machine. In the original illustration there is a crude screening device inserted below the head to retain and recrush any oversize. This has been omitted in the figure as being non-essential to the mechanism under consideration. It will be noticed that the crushed product escaped by falling between the arms of the gear-wheel driving the eccentric and this must have proved an undesirable feature in a machine of any size. Otherwise the crusher is a not unworthy progenitor of the short-shaft machines of more modern times.

Eight years later, in 1877, Charles M. Brown of Chicago filed a patent for the breaker shown in Fig. 2, which may very truly be called the prototype of the thousands of gyratory crushers which have since been put to such useful service. The crushing basin or concave-casing was fitted with removable liners, the long lever shaft carried a renewable cone, a diaphragm-chute for collecting the crushed material was inserted in the lower part of the frame casting, and the bearing for the eccentric was integral with the body. The spider had four arms and consequently four feed-openings, the upper end of the spindle was of the ball-and-socket pattern but trouble had already been experienced with the wear at this point as Brown claims for a ball-socket in four sections held in an outer cylindrical bush or sleeve with means for closing the sections to compensate for wear.

The upper bearing was free to move vertically in the bore of the spider and a screw-adjustment with foot-step bearing was provided at the lower end of the main shaft to allow of the head being raised or lowered as required. From the remarks in the specification it would appear that considerable development had taken place since the appearance of Rutter's patent and Brown does not claim the long lever shaft or general arrangement of the mechanism as novel.

Somewhere about the year 1879 the Gates Iron Works began their long and outstanding connection with the gyratory breaker. It is said that their early machines were founded on Brown's design. Fig. 3, from a patent specification taken out about 1880 under the name of P. W. Gates, will serve to show the changes which had been introduced in the interval.

The spherical joint was retained for the upper end of the shaft but the eccentric was inverted and made to revolve in an oil-well in the bottom cover. The bevel-pinion was not keyed to the countershaft but was attached by a breaking-pin to a collar secured to the shaft, so that instantaneous relief was said to be afforded in the event of any foreign substance falling between the crushing head and the concaves. With two exceptions this machine is typical of the well-known Style "D" Gates crushers which were the standard for so many years.

In 1882, Messrs. Fraser and Chalmers of Chicago were manufacturing the Comet crusher, shown in

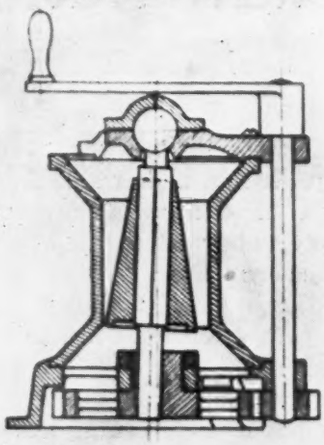


Fig. 1.

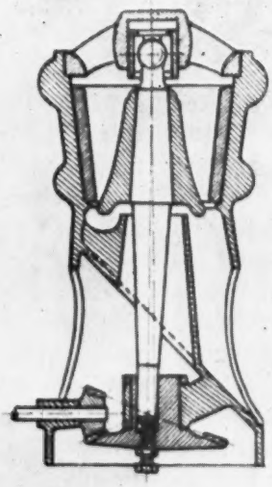


Fig. 2.

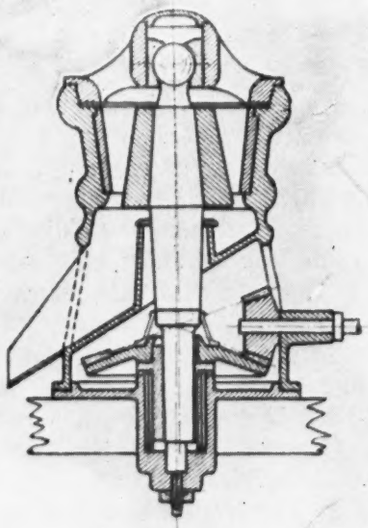


Fig. 3.

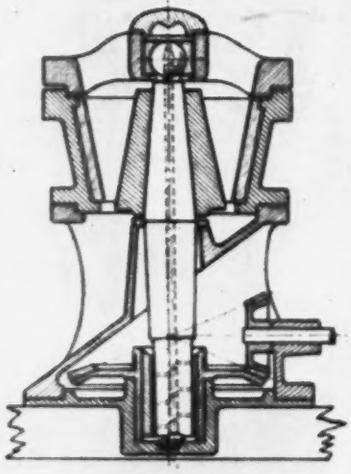


Fig. 4.

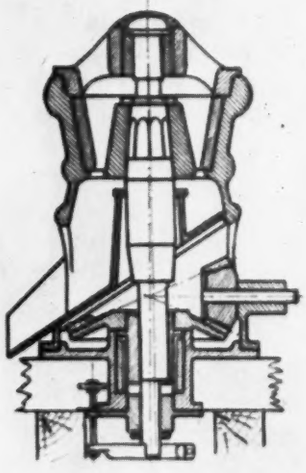


Fig. 5.

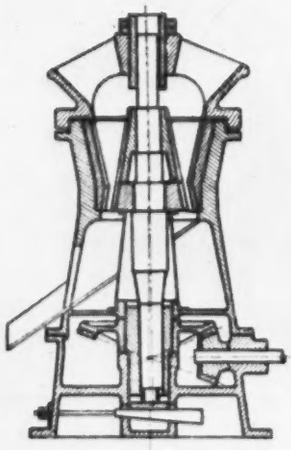


Fig. 6.

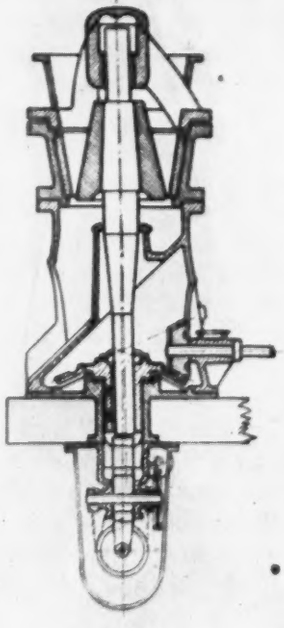


Fig. 7.

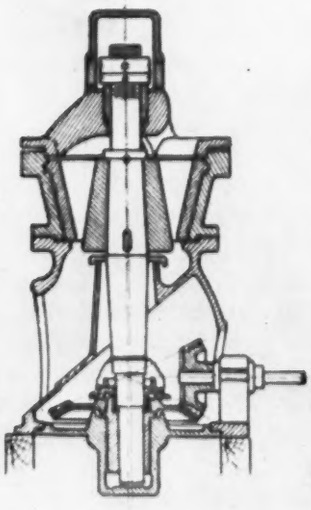


Fig. 8.

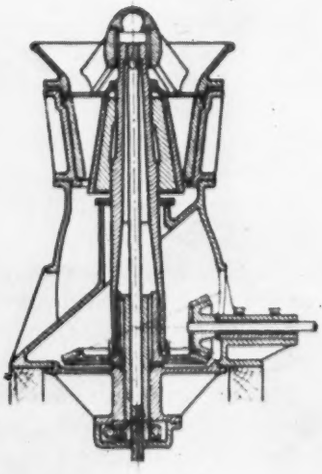


Fig. 9

Fig. 4, in competition with the machines made by the Gates Iron Works. In this breaker a lubricating hole was bored the full length of the vertical shaft with branches to feed the oil through the thickness of the shaft to the inner eccentric bearing. By this means both spider-bush and eccentric could be oiled at the same time from the top end of the shaft.

The essentric-bearing was made in the form of a removable sleeve fitted inside the boss of the large gear-wheel and so designed that it could readily be changed to compensate for wear, or, if so desired, to modify the eccentricity and, within limits, reduce or increase the crushing stroke. No adjusting screw was provided to raise or lower the shaft and crushing-head and this could only be done by changing the thrust-washer supporting the weight of the main-shaft. As previously stated, Fig. 3 might be taken as representative of the Style "D" Gates breakers with two exceptions. The first has reference to the ball-and-socket bearing for the upper end of the spindle, which apparently gave trouble due to uneven wear and proved difficult to adjust satisfactorily.

About 1883, this upper bearing was changed to the part-conical design shown in Fig. 5. This radical departure from previous practice must have entailed considerable courage on the part of its designer. In principle the spherical joint would appear to be ideal for this duty and, since it became obsolete, at least two patent specifications have revived its claims for use in this connection. In service a full bearing is hardly ever obtained between the ball and the socket and, with the reduction of the diameter of the ball by wear and the simultaneous enlargement of the socket, the bearing degenerates to practically point contact causing intensified wear.

When the spider-bush is made parallel in the bore and the upper journal is coned to a taper coinciding with the angle of gyration, the shaft and bearing maintain line contact on the side opposite to the crushing, notwithstanding increased clearance due to wear. The simplicity and durability of this form of bearing have proved to be among the outstanding features of merit in the gyratory crusher. The second point of difference between the outline in the early patent, Fig. 3, and the design known as Style "D," lay in the means adopted for giving freedom of access to the bevel wheel and eccentric.

A careful study of Figs. 3, 4, and 5 will show that it was impossible, in these early machines, to remove the bottom-plate with its journal for the eccentric without dismantling the machine owing to the fact that this particular casting was made to form the bed-plate for the whole structure of the breaker, and the crusher had to be lifted off the base plate to reach the bevel wheel and eccentric. The method adopted for overcoming this difficulty will be explained later.

In 1885, G. Lowry introduced the design shown in Fig. 6, in which the body was made in two sections, each section having a plate diaphragm containing a bearing for the eccentric. The bevel-wheel was inverted and was keyed to the eccentric-sleeve so as to rotate freely between the upper and lower bearings. In this machine the upper end of the spindle was turned parallel and the spider-bush bored taper to allow freedom for the gyratory movement. This bush was adjustable vertically so that it could be moved in unison with the raising or lowering of the shaft, lock nuts being provided to keep the bush in the desired position. The vertical adjustment was obtained by means of a wedge and cotter below the footstep-bearing. Among other features of novelty this breaker had a crushing-head made up of two or more separate rings.

With the exception of minor improvements in details there does not appear to have been any radical change in the design of gyratory crushers for a number of years until R. McCully, in 1892, brought out the suspended-shaft type shown in Fig. 8. Various methods of suspension were tested but the one shown in the figure was that most generally adopted. The upper portion of the main shaft was prolonged through the boss of the spider and screwed for a considerable length. Over the threaded portion was fitted a sleeve capped by double nuts and a thrust washer was fitted below the sleeve resting on a shoulder in the head of the spider. The whole weight of the shaft and crushing head as well as the resultant force from the crushing on the angle of the cone was carried by the nuts through the sleeve to the washer resting on the internal flange of the spider.

In most of the gyratories then in use the main shaft was raised to reduce the size of the crushed product or to compensate for wear on the head or concaves. When the shaft was pushed upwards from below by means of lighter screw, wedge, or lever, the center of gyration was raised and, since the eccentric remained in its original position, the distance between the eccentric and center of gyration was changed, resulting in an alteration in the angle of gyration which caused slight unevenness of bedding on the inner eccentric bearing. If the adjustment was made in easy stages no detrimental effect was noticed but the principle was not theoretically correct.

With the McCully suspended shaft the center of gyration remained constant in line with the top of the thrust-washer so long as there was no undue slackness in the bearing between the sleeve and spider. McCully also claimed to be the first to introduce the idea of a removable bottom plate which could be lowered on hanger bolts into the inspection pit without disturbing the rest of the machine.

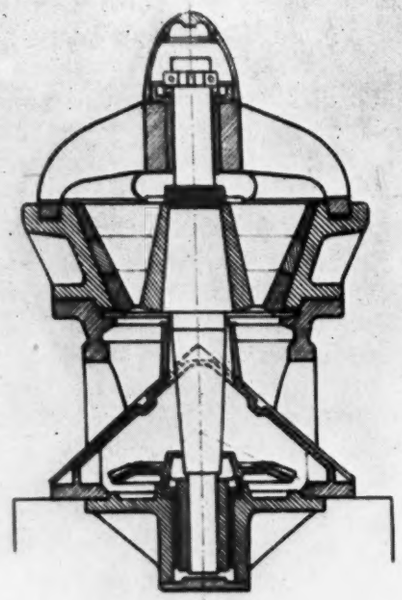


Fig. 10.

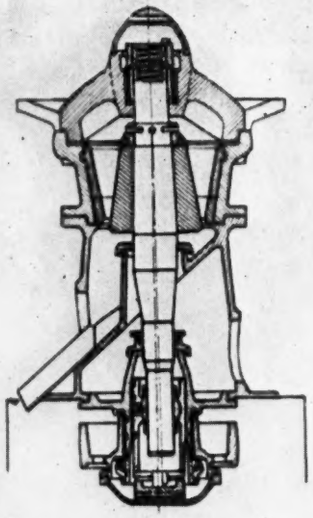


Fig. 11.

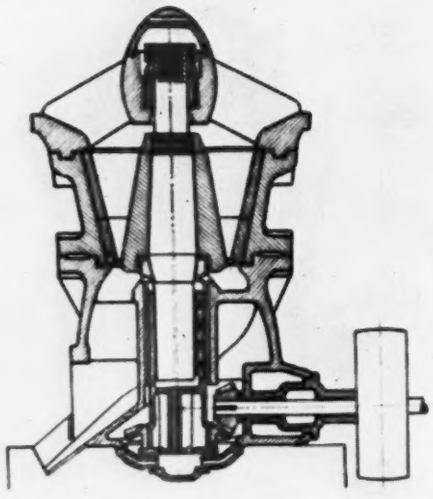


Fig. 12.

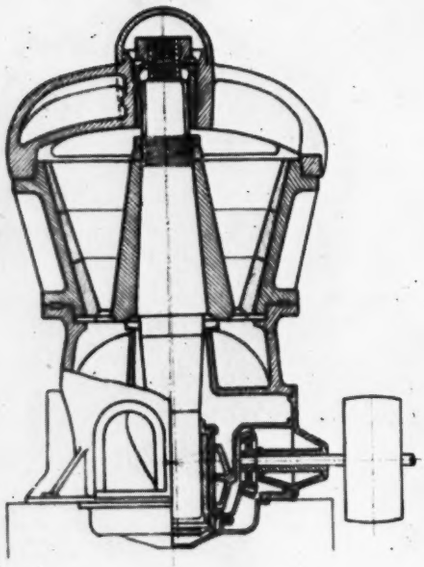


Fig. 13.

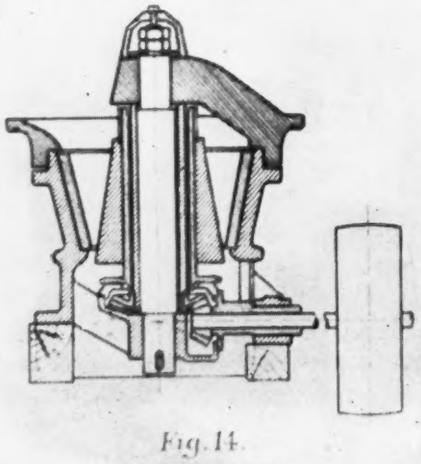


Fig. 14.

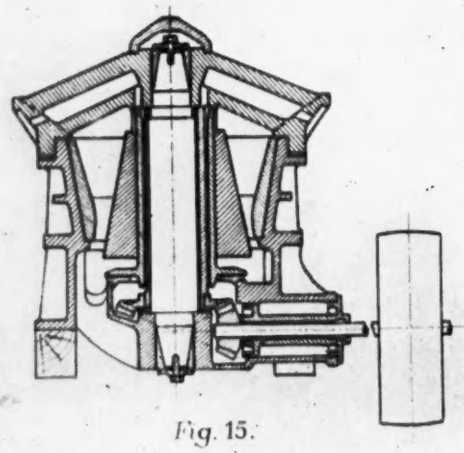


Fig. 15.

This system gave a ready means of access to the bevel-wheel and the eccentric bearings and, in a very short time it was adopted by other gyratory builders and incorporated in the Gates Style "D" crushers.

For a number of years the contest between supported and suspended shafts for gyratory breakers led to considerable discussion and one of the leading manufacturers, after trying out the suspended system, remained faithful to the thrust-bearing at the bottom of the shaft for a long period. Steadily the suspended shaft won its way and today it is virtually the standard for machines of this type. The lack of a ready means of adjustment in their earlier Comet crushers led Messrs. Fraser and Chalmers to introduce about 1895 the adjustable Comet shown in Fig. 7.

The shaft was supported on a vertical spindle carrying a hardened steel cap or thrust-plate. This spindle was encased in a separate casting forming a long extension of the bearing in the bottom-plate. A slot was cut through the spindle and a cross-shaft, carried in journals formed as part of the container, passed through this slot and had a chain-drum secured at one end and a loose sheave and a worm wheel keyed at the other. The lower end of the vertical thrust-spindle was made as a fork supporting two chain sheaves which were free to rotate on a fixed pin, and a chain was secured to the boss of the extension casting and passed round the sheaves and chain-drum in such a way that rotation of the cross shaft raised or lowered the spindle and footstep. The worm engaging the worm-wheel on the cross shaft was turned by a hand wheel placed outside the foundation timbers in a position readily accessible. The whole of this somewhat cumbersome mechanism was housed in a light casing forming an oil-well and dust cover.

Whilst it is true that in many cases it would be better if the shaft and head were adjusted in a little more frequently before the concentrated wear has formed a deep groove in the head, it is not usual to alter the setting so often as to warrant a complicated mechanism of this kind being fitted. In 1899 Hadfields Limited introduced on the English market the novel type of gyratory crusher shown in Fig. 9. In this machine the hopper, spider, and concave-casing were made in cast steel and the concave liners and renewable mantle for the head in manganese steel.

The main shaft was hollow and was supported on a vertical pillar shaft passed right through the bore with a cupped end carrying a single ball at the fulcrum or center of gyration. A hardened steel ball-socket transmitted the weight from the main shaft to this center-post. By this means the thrust was taken at the center of movement of the main shaft, as in the McCully crusher, instead of at the point of greatest movement as in Figs. 3, 5, 6, and 7. In this machine the bottom-plate had a sleeve or stem pressed in to form a fixed pillar-bearing for the bevel wheel and eccentric. The eccentric boss fitted inside the lower end of the hollow shaft and the motion was transmitted to the inside of the shaft. This method of construction ensured absolute freedom from dust entering the eccentric bearings but it was difficult to maintain adequate lubrication.

It is interesting to note that, in the first machine of this type, roller bearings were fitted to the eccentric but, in their primitive form, these proved unworkable under the conditions imposed by heavy crushing. The center shaft passed right through the stem in the bottom-plate with a locking screw engaging a key-slot to prevent rotation, the lower end of the shaft was threaded and a worm-wheel nut was nested inside a thrust cover, adjustment being made by turning the worm with a wrench. These crushers gave good service on light work but under severe conditions the thrust on the cantilever caused the stem to become loose in the bottom-plate and the design was ultimately modified to overcome this trouble.

In the next decade there was a steady growth in the dimensions of gyratory crushers. The introduction of the steam-shovel brought with it a great change in the size of the rocks fed into the crushing machines. The change from handling by man power to mechanical means created a great and growing demand for breakers with larger and still larger feed-openings. These huge crushers were used for sledging purposes and, where finer material was required, the product was delivered to secondary breakers for exact sizing. In many instances, therefore, vertical adjustment of the head was not essential in the larger crushers as some considerable variation in the size of the product was not of very great moment since the secondary machines could cope with a fair margin above the normal setting. This fact led to some modifications in design and notably to a simplification in the system of suspension for the main shaft.

The sloping diphragm forming the collecting chute below the crushing head has always been a source of trouble in the design of the gyratory breakers. This chute may be said to consist of a flat inclined plane fitting inside the hollow cylinder of the lower part of the body. Projecting through the center of the diaphragm is a circular chimney walling round the hole for the passage of the main shaft. This chimney forms a barrier to the free flow of the material from the upper end of the chute which, instead of finding its way by the short cut, has to be deflected on both sides round the obstacle. The lengthening of the path seriously diminishes the actual angle of the slope down which the material travels in the upper part of the diaphragm and, in order to reduce the tendency for material to lodge at this point, a special ridge-liner or saddle-plate is usually fitted to deflect the

crushed material on both sides of the center line. The reduction of the angle of the path of travel at the upper end of the chute is more noticeable because at this point the material seeking outlet has a very short fall and consequently considerably less impetus than that discharging on the lower part of the chute. Theoretically each half of the diaphragm should be designed in the form of a helix so that at a given radius the angle of travel remains constant, but this shape complicates the liners and has so far not been adopted to any extent.

In order to avoid excessive height in the body the angle of the diaphragm and the distance for the drop to the crest of the incline were reduced in the early machines to limits which made it extremely difficult to get a sticky ore to run freely. With the advent of the coarse crusher the need for greater freedom for discharge increased enormously and the double outlet as shown in Fig. 10 was designed by the Allis Chalmers Co., about 1907, to meet the more arduous conditions. The double outlet considerably shortened the path down which the product had to pass and enabled the two ridges to be placed well below the outlet space between head and concaves.

In 1906, Messrs. Symons Brothers brought out their low pattern gyratory, about which more will be said later, and this machine was the precursor of a series of designs for short-shaft gyratory breakers. The long main shaft, which up to this time had been an essential feature, possessed advantages in that it gave considerable leverage and a moderate pressure on the eccentric bearings, but this shaft was liable to deflect slightly under the crushing strains with the inevitable result that breakage occurred sooner or later through fatigue.

In 1909 the Worthington Company put into service their first superior short-shaft gyratory, shown in cross-section in Fig. 12. The body of the machine was reduced in height to the utmost extent possible with a free-running discharge-chute and the eccentric was made to revolve inside the chimney passing through the diaphragm, which was strengthened to withstand the crushing pressure and further supported by bridge pieces spanning the space above the outlet. By raising the eccentric in this manner the spindle was considerably shortened and the reduction in the distance between the supports added fifty to sixty per cent to the strength of shafts of equal diameter.

The shortening of the shaft increased the proportion of the crushing load carried by the eccentric bearings, which were enlarged to correspond, but their new situation made it impossible to retain the old system of oil-well lubrication. The machine was therefore arranged with a geared pump inside the bottom-plate and a system of supply-pipes were combined with a storage tank to ensure an ample supply of oil which was kept in constant circulation, passing upward inside the eccentric and returning on the outside.

The Kennedy Van-Sawn Mfg. Company, in their effort to produce a gyratory breaker which would crush faster than those built to existing standard types, decided to eliminate the bevel gears and drive direct to the eccentric by means of rope or belt transmission. Originally this method of driving was used for the fine crushers only but it was found to give good results and was adopted later for the coarse crushers.

Fig. 11 shows this gearless gyratory. The vertical position of the eccentric in the bottom-plate of the breaker caused the pulley to lie horizontally making a right angled or twisted drive essential and necessitated the supply of an intermediate shaft with jockey pulleys for controlling the belt. Ropes were used with the earlier machines but these did not run well in dusty atmosphere and belt-drives became the standard, although, in some instances, where electricity is the motive power, the motor is now combined in the bottom plate.

The eccentric proper consisted of two parts, an inner bronze bushing with a spherical seating and an outer sleeve, in halves bolted together, which was babbitted on the working face. The sleeve rotated inside the bore of the bottom plate and was lengthened to project below the boss, the closed end being made with driver-lugs which engaged an intermediate coupling connecting with the dished cover attached to the pulley.

The pulley was bored to revolve on the outside of the boss on the bottom plate which was babbitted to form a journal, and the weight of the rotating parts was supported on a ball-bearing thrust-washer which rested on a clamp collar secured outside the lower end of the boss. To complete the connection between pulley and eccentric a cover plate, with projecting lugs formed in the bottom of the well, was bolted to the underside of the pulley so that the snugs engaged with pockets in the coupling-washer which acted as the driver plate. A flexible connection was necessary to prevent the side thrust from the pull of the belt from exerting a racking strain on the eccentric.

This system of construction has been applied to crushers of the largest size with openings sixty-six inches wide, and, while it must be admitted that the elimination of the gears is a distinct gain from the point of view of saving in friction and reduction of maintenance charges, the latter is partly counterbalanced by the extra strain on the belt and bearings due to the twisted drive.

To meet the competition from the short-shaft gyratories the Allis Chalmers Co. introduced their improved Type "N," shown in Fig. 13, about the year 1920. The bottom shell was made as shallow as possible and the outer sleeve for the eccentric bearing was incorporated with the lower part of

the diaphragm in the body casting. The eccentric, however, was not lifted so high as in Fig 12, and, although the shaft was reduced in length as compared with earlier standards, there was still some gain in leverage.

In order to shorten the run of the outlet chutes and to give a strong strut across the body two distinct exit openings were provided separated by a vertical pillar. These openings were sufficiently close together to discharge into a common channel and they had this advantage that the crushed material was not required to travel so far round the circle of the body before it escaped. With a single outlet, unless it was made of excessive width, the two streams of material were drawn together by the side-walls and this not only caused excessive wear inside the body but, under difficult conditions, there was a decided tendency for stone to pack in the corners, and impede the flow. It should be noted that, where the collecting chute outside the body had to be narrowed to suit an elevator or conveyor, the twin-openings, being wider overall than the single outlet, required a longer distance and a greater height from lip of outlet to point of discharge.

It is open to question whether it is right to classify the machine shown in Figs. 14 and 15, among the gyratory crushers. Certainly it has many points of resemblance but the movement is essentially different from the normal gyratory action as the stroke is equal from top to bottom of the head being generated by a parallel eccentric, rotating on a fixed pillar-shaft. In principle this was not entirely novel as Richards in his "Ore Dressing" mentions that S. R. Krom showed in his catalogue an illustration of an improved Rutter breaker in which the crusher head was placed on a long eccentric running its whole length.

The machine invented by Ed. B. Symons would therefore seem to be a reversion to the improved Rutter type. In its early form the bearings both inside and outside of the eccentric were made with long case-hardened rollers fitted in cages. These hard rollers revolved on unhardened faces inside the head, outside the pillar-shaft, and on the inner and outer surfaces of the eccentric. Owing to wear and consequent slackness the rollers jammed and pulled up the machine. Attempts were made to case-harden or otherwise protect the rubbing surfaces but, for manufacturing reasons, babbitt metal was quickly substituted for the roller-bearings and the breaker made as shown in Fig. 14.

When the crushers had been at work for a year or two it was found that the vertical center-post round which the eccentric revolved, although it was originally a good fit in both upper and lower spider bosses, became loose under the reeling action, and the design was changed to admit of adjustable split-cone bushings being fitted over conical ends so as to maintain tight connections.

After going through several styles, and passing into other hands, with changes and improvements at each step in its development, this machine reached the stage shown in Fig. 15, in which form it has met with a considerable measure of success, which has been earned by patient overcoming of difficulties as they arose in operation.

The work which any crusher may be called upon to perform is very varied, the conditions in some instances are much more onerous than in others. Not only may the material be tougher but the machine may be set for finer crushing entailing much greater pressure on the bearings. As compared with the true gyratory breaker, with its lever-shaft and conical travel, the Symons crusher has this defect that the whole of the pressure from the work of crushing falls directly on the revolving eccentric as against something less than half the load in the shortest of the short-shaft gyratories. It is true that this is largely counteracted by increasing the area of the inner and outer bearings and by providing force-pump lubrication, but these same bearings are difficult to renew, and under heavy work, are subjected to irregular wear.

There is one point which should be borne in mind with reference to this shallow-built machine. Although the height of the crusher is very appreciably reduced its installation height remain almost identical with other gyratory breakers. This is brought about by the fact that the circular outlet for the crushed stone necessitates a collecting chute of considerable area which repeats the diaphragm in the standard gyratory crusher so that the height from feed-hopper level to lip of chute is practically unchanged. The above remarks must not be taken as detracting unduly from the merits of this type of crusher which has proved of great service in many plants.

It is advantageous to be able to change the position of the driving pulley in relation to the point of discharge. Circumstances frequently arise in which it is necessary for the drive to be at right angles to the outlet opening, sometimes on one side of the body, at others on the opposite side. There are therefore three possible positions for the countershaft, and, for a number of years, the machine had to be built with a special body to suit the particular drive required. In the Telsmith crusher, shown in Fig. 15, the outlet-chute can be turned in several directions and no special body is required and in the later patterns for standard gyratories provision is usually made in the bottom shell so that the countershaft and pinion may be changed over from direct to right or left hand right-angle drive to suit the installation.

The Symons Brothers Company has recently designed and introduced to the field the new Symons Cone Crusher. The object in building this crusher is to combine, in one machine, the advantages of

both the Symons horizontal and vertical disc crushers. It is claimed that the large ratio of reduction of the horizontal, the fine uniform product of the vertical and the capacity of both are accomplished by the use of this cone crusher.

The gyration of the crushing head in the cone crusher is similar to that of the ordinary gyratory, with the exception that it moves at least five times as great a distance and gyrates faster. The action of the stone is entirely different. The rapid gyration and long movement drops the head from under the stone after each crushing impact and allows the stone to fall vertically away from the outer bowl. The number of gyrations of the head per minute regulates the distance the stone will travel between crushing impacts. The result is high pressure per square inch on the stone and low pressure per square inch on the bearings.

Since the stone falls a certain distance between crushing impacts, the angle between the head and the outer bowl regulates the amount of reduction at each stroke. The lower part of the head and the lower part of the outer bowl are parallel for a sufficient distance to insure the head making one complete gyration before the material will drop the entire width of the zone. This means that the closed side of the crusher regulates the maximum size of the product.

The crusher consists of a conical head gyrated, not rotated, by an eccentric that is driven through gears and a countershaft. The head is supported by a large socket bearing with no bearings or spider above the crushing cavity to obstruct the flow of material. Opposing the head is a crushing bowl threaded on its outer circumference for the purpose of raising or lowering it. The bowl is held in place by an adjustment ring, threaded inside to fit the bowl threads, and held down on the main frame by a circle of long springs. These springs are flexible enough to allow the bowl to raise the full movement of the head when tramp iron or other non-crushable material enters the crushing cavity. The maximum pressure that can be produced by these springs is a known factor, and as this governs the strains in all parts of the crusher, it is possible to build every part with sufficient strength to avoid breakage. A feed distributing and regulating plate is mounted on top of the main shaft with a vertically adjustable feed spout above it. A large oil tank and pump form a part of the standard equipment. The pump may be motor driven or flexibly connected to the countershaft of the crusher.

To change the size of product or take up wear, six screws are loosened to allow clearance in the bowl threads. The bowl is screwed up or down with the aid of two ratchet lever windlasses. Then the desired setting is obtained, the bowl is locked in place by dropping a pin or bolt through a lock link. The six screws are then tightened to prevent play in the bowl threads. These crushers are manufactured in five sizes, 2, 3, 4 5½ and 7 foot cone and require 25 to 30, 50 to 60, 75 to 100, 125 to 150, and 150 to 200 horse-power, respectively to operate them.

This short narrative, covering the development of the gyratory crusher, is naturally limited to the salient features in design and no mention has been made of many improvements in details which have been introduced during the last fifty years. High-arch spiders, cut-steel gears, manganese steel wearing parts, and improved methods of lubrication, have added greatly to the merits of this breaker as one of the most useful crushing machines in service at the present time.

Average Worker's Cash Value $17,500

The American Statistical Society claims that the life value of the average American is $17,500, including non-workers. Every worker represents a cash estate and has a cash value comparable to that of property which may be appraised by estimating the present cash value of his future earnings. The life value of the worker is much higher than that of the non-worker. An individual who may expect to earn $3,000 a year for 30 years would have a life value of about $45,000 discounting earnings at 5 per cent compound interest.

A Tremendous Tourist Business

Conservative figures compiled by the American Automobile Association, based mainly on last year's travel records, place the value of the motor tourist caravan during 1927 at a total of $3,300,000,000. Approximately 40,000,000 people, a third of the total population of the United States, will vacation in 10,000,000 automobiles during 1927. The tourist business has become in fact one of the biggest industries.

What Is Average Living Cost?

Miss Ina S. Lindman, food specialist and home economist, revealed the results of a survey concerning living cost of 25,000 typical American families at the recent exposition of the American Farm Bureau Federation. The conclusion resulting from the survey is that it costs $1,434 a year to support the average family of 4.88 persons. The average income for the families surveyed was $1,513 per year.

Hardening Stone

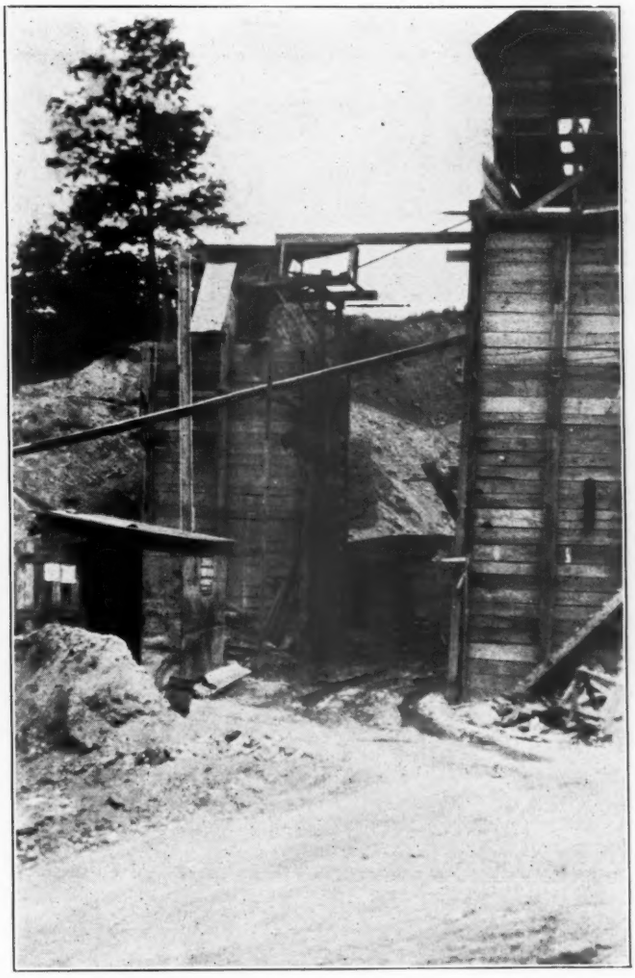
Natural or artificial stone is heated to about 250 degrees C. and brought into contact with a bituminous substance heated to a lower temperature. Sulphur is either added to the bituminous substance or applied to the impregnated stone, which is then heated to vulcanize the bitumen.

A TWO MAN SAND AND GRAVEL PLANT

SITUATED about one mile from Cornell University, a short distance outside the city at Ithaca, New York, is the sand and gravel plant of M. Mead Reynolds. The bank is between sixty and seventy feet deep. It is covered with about three or four feet of gravelly loam which is removed in the process of washing. The entire pit covers about two acres. The plant was started about seven years ago. The first year the material was screened from a trestle to a bin and this process required the labor of ten to fifteen men. Later the installation of electric motors throughout did away with this large amount of manual labor and the plant now requires only two men besides the owner, who is superintendent of the entire plant.

The material is drawn from the bank by a Sauerman one-half yard crescent scraper to a hopper covered by a grizzly of railroad iron spaced five and one-half inches apart from where it falls to a Telsmith plate feeder, feeding to a thirty-six by forty inch scalping screen with one and one-half inch perforations. The oversize falls to a number 1½ Climax crusher from which it is raised by a Good Roads elevator and returned to the scalping screen. The material passing through the scalping screen falls to a Good Roads elevator fifty-six foot centers. This elevator carries the material to the top of a bin where it is discharged to a Telsmith heavy duty washing screen with a four foot scrubber section and five foot screen section with one inch perforations surrounded by a four foot sand jacket of four by four mesh wire cloth. The gravel is separated into two grades; that passing through the one inch perforation falling into a number one bin, and that passing over the one inch perforation falling into a chute to a number two bin. The sand and water falls to a steel pan, flowing into a number 5 Telsmith settling tank. The concrete sand is discharged from the sand tank to a bin below. The water and mason sand from the number 5 sand tank flows through a flume to a number 6 sand tank mounted on a bin twelve feet distant from the main bin, which catches the mason sand. The water, after leaving the number 6 tank, is recirculated by a five inch Goulds pump back to the washing screen to provide sufficient flow of water for carrying the fine sand through the first tank. The reason for the recirculation of the water is because of the use of city water for which one and one-half the city rate is paid.

The crusher, crushed stone elevator, the feeder and scalping screen are driven by a twenty-five horse power G. E. slip ring motor; the main elevator is driven by a five horse power Westinghouse motor; the heavy duty washing screen is driven by a five horse power Fort Wayne motor, and the Gould pump by a five horse power G. E. motor. Telsmith sliding bin gates with water seal are used throughout.



Mason Sand Bin and Sand Tank

The arrangement of the scalping screen allows accurate control of the final size of the gravel by changing to a screen with different perforations. A recent order for three inch material was filled by changing to a screen with three inch perforations and on completion of the order the change back to one and one-half perforations was made, this being the standard grade. When the bin is full, surplus sand is spouted to a stock pile by a V shaped trough direct from the number 5 sand tank. This stock pile will contain five or six hundred yards of material.

The material is delivered to the local trade by a two and one-half yard Mack and a one ton Ford truck. Considerable material is sold to truckmen at the plant. The plant as described was entirely rebuilt during the last year, the motors and part of the machinery of the old plant having been used.

Scraper in the Bank

Hopper and Receiving Unit

A capacity of 150 yards in a nine hour day of sand and gravel is possible with the new equipment.

Hardening of Silicated Roads

The hardening of the stone material which has been impregnated with sodium silicate is due to the formation of colloidal SiO_2 which, in coagulating, encloses the stone portions into a very resistant mass. In this effect absorption of the solid bodies plays an important role which by drying, dialysis or the influence of CO_2 can be still further increased. R. Feret (Compt. rend. Acad. Sciences 184, 935-37).

Automatic Shaft Kiln for Burning of Cement, Etc.

The raw material mixed with fuel are blown in from underneath and the finished burned (sintered) material falls back and is removed, whereas the unfinished goods are separated from the burning gases in a dust chamber and used over again. The kiln is capable of large output and continuous operation. C. Naske (German Patent 444, 185).

Grinding Cements Very Finely

Portland cement is obtained in a very finely divided condition in which it reacts quantitatively with water by grinding it together with a harder siliceous substance such as quartz, granite, macadam slag, or quartz sand, and separating the ground cement from the coarse particles of added material by blast separation methods. The added material becomes partly disintegrated during the grinding, and to prevent that portion of it which is so finely ground as to remain mixed with the cement from exercizing a deleterious effect thereon, lime is added to react with it. L. Forsen (British Patent 272, 163).

Blast Furnace Slag as Aggregate

Blast furnace slag can be positively identified in concrete by use of the quartz ultraviolet lamp in conjunction with a water curing. The German Concrete Society recommends that blast furnace slag not be used in important structures until completion of their investigation of test pieces which may be had for a reasonable sum. Anon. (Beton u. Eisen. July 20, 1927, pp. 279-280).

SIMBROCO COMPANY CUTS HAULING COSTS

IN collaboration with Arthur C. West, Treasurer of the Simbroco Stone Company of Boston, Mass. the A. C. Neilsen Company has made a survey of hauling costs which should prove of comparative value to other stone companies. Stone, gravel and sand produced by the Simbroco Stone Company was delivered in rented trucks until 1921, when the volume of hauling made it advisable to begin building up a truck fleet.

The first two trucks were put into service in 1921 and two additional orders have since been placed.

Trucks are ordinarily operated for 6 ten-hour days each week. Operation is intermittent during the winter, but the entire fleet is in regular use during the remainder of the year. Additional truck capacity is sometimes obtained by renting during the summer. Trucks carrying stone operate within a radius of 50 miles but occasionally make 100-mile runs. Loading is done at the Simbroco yards with an overhead traveling crane, the pieces ranging in weight from 100 to 1600 pounds. The average weight is about 300 pounds and the average truck load is approximately 7 tons. The sand and

Operating Cost on One 5-Ton Sterling Truck Equipped With Dump Body

INVESTMENT:			
Total, with body, hoist and tires	$6,380.00		
Less tires	695.94		
		$5,684.06	
Less turn-in value		1,000.00	
Net			$4,684.06
ANNUAL FIXED CHARGES:			
Depreciation—$4.684.06—4-year life			$1,171.02
*Average interest at 6 per cent—5/4 × $4,684.06 × .06/2			175.65
Interest on trade-in value—$1,000.00 × .06			60.00
License, taxes and insurance			478.31
Garage			90.00
Total annual fixed costs			$1,974.98
DAILY OPERATING COSTS:			
Fixed—			
$1,974.98—300 days per year			6.58
Variable—			
Repairs and maintenance (estimate, including parts and labor) $900.00—300 days			3.00
Tires—			
Rear—($519.54—15,500 mi.) × 60.4 mile-day			2.02
Front—($176.40—24,500 mi.) × 60.4 mile-day			.43
Gasoline—14.4 gal./day at $.18 per gal			2.59
Oil and grease			.16
Driver's wage (average, per day)			6.50
Total daily operating cost			$ 21.28
UNIT HAULING COSTS:			
Per mile—$21.28 a day—60.4 mile-day			$ .353
Per ton—$21.28 a day—49 tons			$ .435
Per ton mile—$21.28—(7 tons × 60.4—2 miles)			$ .101

*Allowing for interest earned by depreciation reserve.

The present fleet totals fourteen 5-ton chain-drive Sterlings. Twelve are equipped with standard rump bodies and with Heil or wood hydraulic hoists are used for hauling sand and gravel. Two equipped with platform bodies are used in the delivery of concrete products for building construction. All trucks have solid tires all around, 36x7 inches in front and 40x14 inches in the rear.

gravel trucks usually make seven 8 to 9 mile trips in a 10 hour day carrying average loads of 7 tons. Gravel is loaded by gravity from overhead storage bins and sand is loaded from the ground by an automatic loader.

The repair and maintenance cost of the trucks is low. Cylinders do not ordinarily require grinding until a truck has made 35,000 to 40,000 miles.

Complete overhauling has never been required under 65,000 miles. Bearings have given no trouble and valves are ground on an average of twice a year. A cost analysis is shown below for one of the 5-ton dump-body trucks. Depreciation and average interest at 6 per cent on the net investment have been calculated on the basis of a four-year life. This is an extremely conservative procedure in view of the manner in which the trucks are standing up in this work.

Other fixed charges include straight 6 per cent interest on the trade-in value, license, taxes, insurance and garage expense. The total is $1,974.98 a year or $6.58 a day on the basis of 300 days' operation. Variable operating costs include repairs, tires, gasoline, oil, grease and driver's wage. The total average daily operating cost is $21.28 and the unit hauling costs are $.353 per mile or $.435 per ton of stone handled.

Office Economies

Regulation letterheads should not be used for inter-departmental correspondence. Plain manila, cut half-size, even when printed will yield a saving almost astonishing in its size when considered over a year's period. Telegrams should not be sent during the last rush hour of the day when letter might reach the customer on the following morning—merely because there had been no time to write a letter.

Pencil sharpeners in general are wasteful appliances. They whittle too much of the graphite away, sharpen the point so that the lead wears too rapidly, and frequently split the wood or break the lead so as to necessitate resharpening. The claim of "time saving" for pencil sharpeners is sheer bunk. Everyone, from the office boy to the chairman of the board, has time to sharpen pencils, if only during conversations or interviews. One large corporation ordered these devices taken out of their offices, and a supply of pencil extensions provided. During the first year a saving of $1200 resulted.

Obsolete forms, blue prints, shop order blanks, etc., can be glued, trimmed to size, and made to serve as scratch pads. In offices of average size or larger a central duplicator bureau is a necessity. Frequently there is a vast amount of repetition work done on typewriters which could be accomplished at a fractional cost on a duplicator.

Typists and stenographers should never have free access to carbon paper, typewriter ribbons or supplies. If they do, the consumption of such supplies will be noticeably higher than where some one individual has been delegated the responsibility of supply maintenance and issuance. Periodic check-ups and investigations of clerical or subexecutive duties will frequently reveal possibilities for "doubling up" jobs to the elimination of one wage earner.

New Lime Association Program Now in Effect

The board of directors of the National Lime Association met with the executive committee in Washington on July 15. Mr. J. F. Pollock, vice-president of the Ash Grove Lime and Portland Cement Company, was elected chairman of the board. This complies with the request of the past convention that the board should elect an executive head of the association. Mr. G. B. Arthur was re-elected general manager to serve throughout the coming year.

At the recent lime convention at White Sulphur Springs, it was decided to curtail the expenses of the association, reduce the dues and concentrate on building a membership more representative of the industry. The research and field work was dropped entirely.

The commitments for membership already returned put the new program into effect at once, with a headquarters force sufficient to adequately represent the industry, and to support the individual efforts of members as well as the collective efforts of groups as they are organized. The publication and distribution of association literature will be continued, and technical help can be given on specific problems. Outside of the National office, the plan of the convention is to be carried out vigorously. The board is committed to the idea of a larger membership, which will represent the entire industry, to attain this representation as quickly as possible, and to broaden the association work through the medium of group organization by the members.

In cooperation with directors and members, this program will be presented to every responsible manufacturer and meetings are to be held for each group of members, so as to bring about unity of action in these groups. A general meeting of the industry will be called whenever it appears that the industry is ready for it.

The board of directors appeals to every thoughtful manufacturer for the broad and unselfish consideration of his interests—as bound up in the welfare of the industry—which will put this forward movement ahead of every other consideration. This is a time when the industry needs the best that every lime manufacturer can offer, in a fully representative and constructive effort.

The board of directors includes J. F. Pollock, chairman; J. M. Deely, W. F. Stolzenbach, Henry LaLiberte, A. V. A. Felton, G. J. Whelan, J. M. Gager, S. W. Stauffer, G. J. Nicholson, M. McDermott, Reed C. Bye, E. S. Healey, H. Dittlinger, S. M. Shallcross, B. L. McNulty, J. S. McMillin, W. E. Carson, R. C. Brown, C. M. Cadman, J. J. Urschel, and G. B. Wood.

MICA
SOURCES, PRODUCTION AND MARKETS

By W. M. Myers
Mineral Technologist, U. S. Bureau of Mines

Part II

PART I of this article, which appeared in the August 3rd issue of Pit and Quarry, dealt with the varieties of mica, some of its unique physical properties, mining methods and systems of grading. In the following final installment Mr. Myers gives some interesting facts in regard to the uses of mica and suggests methods by which producers can secure the maximum return on a given investment.—*Editor.*

Mica may be briefly classified as sheet, splittings or scrap. Sheet mica is used principally for electrical purposes and for glazing, splittings are used for the manufacture of built-up board, and scrap is ground to a powder. Mica to be classified as sheet must yield a rectangle of at least 1½ by 2 inches, must split evenly and freely, be free from cracks, ruling or plications, and be reasonably free from inclusions or stains of foreign matter. In order to be profitable a deposit should yield at least a small percentage of sheets considerably larger in size than that given above. A high grade of mica is also required for spark plugs, particularly for those used in airplanes. Such mica must be very flexible so that it may be wound in small cylinders without cracking.

Its ability to withstand heat and its high electrical resistance has led to a wide application of sheet mica in the electrical industries. The electrical uses of sheet mica greatly exceed all others both in quantity and value of the material used. An important use of electrical mica is for inter-leaving between the copper segments of commutators. Its adaptability for such a purpose depends chiefly on its dielectric strength, that is, its ability to resist disruptive discharge due to difference in potential between the segments on either side of it. Only high-grade mica free from iron impurities, pin holes or cracks may be so used. Another important feature is its hardness. It is essential that a soft variety of mica be used in order that the copper and mica may wear down evenly. India mica is widely used, but as regards softness it is claimed that the Canadian amber mica is superior to all others.

Thin films are used in vast numbers in condensers for magnetos and wireless apparatus. A very high quality of mica is demanded for condenser use. It must be clear ruby, colorless, or greenish, must split easily into smooth plates one-thousandth of an inch thick, must be free from cracks, holes, stains, spots, wrinkles, rulings or knots in any form. Large sizes are not required, 2x2 or 2x3 inches being those ordinarily used. For wireless outfits each film must be capable of withstanding 20,000 volts. For magneto condensers a much lower electrical resistance is permissible. The rapid development of the radio industry has created a market for large quantities of mica, particularly in the smaller sizes of sheet material suitable for the manufacture of condensers. As sheets in greatly diversified shapes, or as washers and tubes, mica is used extensively as an insulator in dynamos and in various fittings or appliances, in fuse boxes, sockets, insulators, electric heaters, flat-irons, telephones, etc. The highest grades of electrical mica are required for condensers and spark plugs, but for uses where low-voltage currents are employed less perfect mica, containing a limited amount of impurities, may be used.

As a heat-resisting transparent medium sheet mica has various uses. It was formerly widely employed for stove windows, but this use has declined to a considerable extent. A hard and rigid mica that is nearly clear is best suited for stove fronts. Domestic mica, particularly the green mica from North Carolina, is well adapted for this use. Stove No. 1 must be free from cracks and stains, but may contain "air bubbles." Stove No. 2 may be spotted and stained to a limited extent. High-grade stove mica commands a higher price than electrical mica, because for the most part larger sizes are demanded. Mica is also used in furnace sight-holes, heat screens, lamp chimneys, canopies and shades, particularly for gas mantles, also for military lanterns and in lantern slides. Micalite is a trade name given to sheet mica used in mica chimneys, canopies, etc. For lamp chimneys and canopies the mica must be clear and transparent, must split easily and be very flexible. India and Brazil mica are used chiefly for such purposes; it is claimed that very little domestic mica is suitable.

Its ability to withstand shocks and strains combined with its transparency has led to wide use in motor goggles, spectacles, diver's helmets, smoke helmets, compass cards, gage fronts, and in windows subject to shock as in the conning towers of warships. Owing to the resonance of mica, circular sheets of high-grade muscovite were formerly used extensively in phonographs, as sound-producing devices. Such sheets are used also in other sound-detecting instruments such as submarine detectors. Diaphragm mica must be clear and transparent,

free from all cracks, inclusions, stains or rulings, and must split easily into perfectly flat sheets, the latter feature being essential. Due to the recent development of a new type of phonograph in which no mica is used the market for diaphragms has greatly decreased.

Among miscellaneous uses are its application for ornamental uses, particularly in India, as a dressing for wounds and as a substitute for canvas in portrait painting. A demand for very large sheets capable of supplying 18 inch circles has been noted. These large mica sheets are used as a base on which scenes are painted for projection upon the stage. The cost of producing theatrical transparencies is high and they are subjected to high temperatures and rough handling. The mica is therefore favored over glass or celluloid or similar substances which are fragile or combustible.

Mica splittings consist of thin flakes split from the smaller sheets or from waste fragments. They are used chiefly for the manufacture of built-up mica board. This built-up board is produced from alternate layers of splittings and shellac or other binder. The finished board is baked under pressure and machined to desired dimensions. Built-up mica is used chiefly for commutator segments, and in various forms in dynamos, motors, and transformers. For general insulation purposes built-up mica is as good as the natural product, and is superior to it in its adaptability for shaping to suit special requirements. It is uniform in thickness and in quality and is free from foreign matter and flaws that commonly reduce the resisting power of sheet mica. It is free from the polarity developed in sheet mica, has stronger cohesion between the plates, and has a lower water absorption than sheet mica. Built-up mica may be easily sawed, cut or bent, and when cut leaves clean edges. Splittings are also used to cover tape and paper to produce a high-grade flexible insulating medium which may be wrapped or folded in any desired manner.

Scrap Mica

Scrap mica consists of the material which, due to imperfections, can not be used for the manufacture of sheet goods. Trimmings of sheet material are also classified as scrap. A few mines have been operated for scrap alone. In these properties the mica was found in large quantities, but was either too small in size or too imperfect for use as sheet. With an increased demand for scrap mica more attention has been paid to its recovery from other sources. Considerable mica associated with feldspar and kaolin is recovered as a by-product and sold for grinding.

Although mica is classified as a soft mineral it is one of the most difficult to grind, due to its flexibility, smooth surfaces and lack of brittleness. It can not be crushed but must be shredded, torn and split to bring it down to the desired fineness. Mica is ground by both wet and dry methods. In general the tendency is to use dry grinding to produce fairly coarse material and wet grinding for the finer sizes. Wet grinding has an additional advantage that the mica particles produced are smooth and reflect light efficiently, which is important where the mica is used for ornamental work on wallpaper, as its luster is dependent on the smooth surfaces of the individual mica flakes.

A number of devices have been employed to grind mica by dry methods. At present the hammer mill is the most important and satisfactory equipment for this purpose. The most common procedure is to feed cleaned and dried scrap to the mill, where the beating action of the hammers tears the sheets apart and disintegrates them. The ground mica is discharged through the hammer-mill screens and is then elevated to vibrating screens which produce the desired sizes. Oversize from these screens is returned to the mill for further grinding. This type of equipment is simple, efficient, and readily installed. Special disintegrating devices based on the action of the hammer mill have also been employed.

The process employed by a Denver firm some years ago for the manufacture of mica lubricant was as follows: The mica cut into fragments about ½ inch square was fed through pneumatic tubes to pulverizers consisting of two interfingering beaters rotating in opposite directions with a velocity of 5000 to 7000 revolutions per minute. The beaters operated in a closed case. The pulverized material was carried by pneumatic tubes to a series of six settling bins. The air current was so retarded that the pulverized mica settled in the various compartments according to size. Mica powder drawn from the various bins was mixed with oil for lubricant manufacture. The mill had a capacity of 5 tons per 10-hour day. Air separation has been used to separate mica from associated impurities. This has been found to be particularly suitable for the preparation of ground mica from mica schist in which the mica is interlocked with other minerals.

The application of pyroelectric methods of separation, which have been found to be satisfactory for the separation of mica from sand, would seem to have some possibilities for the treatment of mica schist or similar materials in which the mica is associated with quartz and other minerals so that a mechanical separation must be made in order to prepare a marketable mica product. Before grinding the mica scrap is washed to remove sand and other adhering impurities. If a ground mica product free from grit is desired, shop scrap, consisting of trimmings produced in cutting sheets, is used. Mine-run scrap may be used with little preparation if clean and free from other minerals. If other minerals, such as quartz and feldspar, are present with the mica they must be removed and the clean

mica selected with care. The users of wet-ground mica require a product of much greater purity than ordinary dry-ground material and for this reason the scrap must be cleaner and must be prepared with greater care.

The methods used for wet grinding have recently been described. It may be stated briefly that two types of mills are used. The first is an old style mill which is composed of an upright cylinder, approximately three feet in diameter and three feet high. This cylinder, or tub, is constructed of wooden blocks with the end grain exposed for maximum resistance to abrasion. A wooden wheel connected to a vertical shaft by which it is revolved fits loosely inside the cylinder. The cylinder is charged with scrap mica and water and the contents are agitated by the revolving wheel. The mica is ground by mutual abrasion of one particle on the next. Grinding is continued until the desired fineness is obtained, 8 hours being required to produce 300 to 400 pounds of ground material. After grinding the mica is removed from the mill and dried on steam coils and then bolted through the screens to produce a sized product of the desired dimensions. Oversize is returned for further grinding. The capacity of these mills is small and the grinding a slow process that can only be carried on where power is cheap. Water power is commonly used for this purpose.

The inefficiency of these mills has resulted in attempts to improve milling practice and a second type of wet mill has been evolved. These mills are much larger and have greater grinding capacity. They consist of steel or wooden cylindrical tanks, approximately 10 feet in diameter and 3 to 4 feet deep. Four wooden rollers, 30 inches in diameter and with a 24 inch face, are revolved by a central shaft. Scrap mica and water are charged in the mill and the mass agitated by these rollers until grinding is complete. The ground mica is then removed, dried and screened. The capacity of some mills of this type is reported to be as great as one ton of ground mica in 5 hours.

Uses of Ground Mica

One of the largest uses of dry-ground mica is in the preparation of rolled roofing and asphalt shingles, where it is employed to prevent sticking between adjacent surfaces. The flaky nature of each mica particle makes it exceptionally suitable for this purpose, as the surface exposure per pound is very great. The comparatively large area of each flake prevents absorption in the asphalt. On asphalt shingles it is reported that from 0.60 to 0.75 pound of mica is required per square of 108 square feet. Coarsely ground mica is used extensively for ornamental purposes, particularly for "Christmas tree snow" which is sold in considerable tonnages at holiday time. It is also used for the surfacing of stucco and concrete to imitate granite. Its use has also been reported for annealing steel, as a component of explosives, in calico printing, in paints and as an inert filler.

Wet-ground mica is in demand by the manufacturers of wallpaper for the decoration of papers where it is desired to bring out a lustrous pattern. The ground mica is mixed with suitable adhesive and placed in a trough connected with the printing presses. A continuous belt feeds the mica to the printing roll which fixes the desired pattern on the paper as it passes through the press. No suitable substitute for mica has been found for this purpose, as other materials do not possess or retain the desired luster. Considerable ground mica is consumed in the manufacture of auto tires, where it is employed as a lubricant. The tires are dusted prior to placing in the mold for vulcanizing and also before packing for shipment. Mica for this purpose must be free from grit and impurities and be ground fine. Specifications for fineness commonly call for 100 per cent through 100 mesh and as much as 88 per cent through 200 mesh. The hard-rubber industry also uses some ground mica. Mica mixed with greases is used in the preparation of special lubricants for metal bearings. The presence of mica decreases both friction and temperature. It has been reported that ground mica may be bonded with lead borate to produce a molded insulation suitable for high-frequency currents such as are encountered in radio. This material is said to become plastic when heated, so that it can be molded readily and combined with metal parts. It is suitable for the bases of radio tubes, aerial insulators and similar applications.

Varieties Other Than Muscovite

Phlogopite is the only variety of mica other than muscovite which possesses the necessary qualifications and is found in sizes large enough to be used in the same manner as muscovite. Phlogopite is often called amber mica, due to its amber-like color, and sometimes is termed magnesium mica because of its high magnesia content. Although this mica has been found in this country in New York and New Jersey it apparently does not occur in sufficient quantity to justify mining, and the demands for this type of mica are supplied by imports from Canada and Madagascar. The occurrence of phlogopite in Canada has been described by de Schmid. Phlogopite is not found in pegmatites but in veins associated with calcite, pyroxene and apatite. The occurrence in Madagascar is reported to be similar to the Canadian. The mining, preparation and utilization of phlogopite is very similar to muscovite. It is manufactured into sheets, splittings for built-up board, and the scrap is used for grinding. Phlogopite mica is exceptionally resistant to heat and one of its principal uses is in appliances operating at temperatures above 500° C. Phlogopite suitable for use in

heating units should be able to withstand a temperature of 800° C. for 2 hours without showing signs of dehydration. Mica board made from phlogopite splittings is commonly used between commutator bars. It is particularly useful at this point, due to the ease with which it wears down evenly with the copper so that projecting ridges do not form. This is said to be due to the softness of the mica; however, there appears to be considerable difference of opinion concerning the relative softness of phlogopite and muscovite mica. In mineralogical text books the hardness of phlogopite is reported above that of muscovite. The ease with which phlogopite wears down in the commutator may be due more to friability and brittleness than to an inferior hardness. When muscovite is used in commutators it is customary to undercut the mica to prevent the copper from wearing down faster than the mica and producing projecting ridges of mica. The commercial production of phlogopite mica in Madagascar was first begun in 1918. Since that date the output of mica has rapidly increased so that the Canadian miners have encountered keen competition from this source.

Biotite, the black iron-bearing mica, is of no importance industrially. It is found commonly in small scales and possesses an imperfect cleavage, no transparency and poor insulating properties, so that it is of little value. It is found occasionally in fairly large sheets in pegmatites which are being operated for the production of feldspar. Its presence here is very objectionable as it ruins the feldspar for ceramic use. The treatment of garnet ores in which the garnet is associated with biotite has made available small tonnages of this mineral, but little market has been found for it. It may be ground and used in the preparation of rolled roofing, but its dark color and poor covering power make it of little value for even this market.

Lepidolite, or lithium mica, occurs in large massive aggregates composed of small scales. It has not been found in this country in large enough size to permit the cutting of sheet material. It has been reported in Australia in larger crystals which allowed the preparation of fairly large sheets. The massive aggregates of this mica generally display a typical lavender color. Large tonnages are available in New Mexico, California, and South Dakota. Although lepidolite contains a considerable percentage of lithium it is not used extensively as a source of this element. Spodumene and amblygonite, the principal sources of lithium, contain a greater lithia content which is more readily recovered. The principal use of lepidolite is in the manufacture of glass, where it is introduced as a source of alumina and alkali. For this purpose it is essential that the iron content be low, preferably not over 0.05 per cent ferric oxide. It is generally ground to 40 mesh or finer.

Roscoelite, sometimes called the vanadium mica, has been utilized as a source of vanadium. The best known deposits are located near Placerville, Colorado. No other use for this variety of mica has been reported.

Sericite is a secondary form of muscovite, produced through the alteration of other minerals. It occurs only in very small scales. In chemical composition it resembles muscovite. It is used for grinding to produce a product similar to the ground mica produced from scrap, and is used for the same purposes in the roofing and rubber industries. Its potash content makes it a potential source of this element.

The term "vermiculite" is applied to a group of micaceous minerals which generally are alteration products of mica. The original cleavage is partly retained; other physical properties and the chemical composition exhibit varying degrees of alteration. Until a few years ago the known deposits were so small that vermiculite was considered a mineralogical curiosity. The discovery of large quantities of this material in Montana has attracted attention to the commercial possibilities. The most pronounced characteristic of vermiculites is the great expansion when the raw mineral it heated. This expansion or exfoliation takes place in only one direction, at right angles to the cleavage, and during expansion the volume increases up to sixteen times the original. At the same time the color changes from a black or dark brown to a silvery or golden hue, according to the degree of heat and the exposure to the air. This change of color is believed to be caused by the oxidation of the iron in the mica and therefore to vary with the amount of oxygen available. The expanded product has been found to be an excellent heat insulator and sound deadener, and to possess possibilities as a paint and calcimine pigment. It also may be used in the decoration of wallpaper. It is expected that the investigations of the properties of this mineral which are being carried on will result in appreciable industrial utilization.

Mica schist is a metamorphic rock in which the mica is present in small scales in association with other minerals. The amount of mica present in these schists varies greatly. In some specimens mica may make up 90 per cent of the rock mass, and in other specimens only a few per cent. If the mica can be separated from the other minerals it is suitable for grinding and may be utilized the same as scrap mica. The separation of mica schist requires rather elaborate equipment. Experimental work has been carried on with several different types of machines. It has been found that schist can be concentrated on tables, the mica floating off on the tailing side, although it may be heavier than other minerals which are discharged on the concentrate end. The mica particles, on account of their flat shape and comparatively large surface, tend to float on the sur-

GROUND MICA SOLD OR USED BY PRODUCERS IN THE UNITED STATES, 1923-1925, IN POUNDS

Year:	Dry Ground		Wet Ground		Total	
	Pounds	Value	Pounds	Value	Pounds	Value
1923	5,660,000	$123,450	4,203,000	$250,170	9,863,000	$373,620
1924	5,184,000	101,700	5,735,000	331,410	10,919,000	433,110
1925	5,043,020	101,680	4,803,930	279,940	9,846,950	381,620

MICA IMPORTED FOR CONSUMPTION IN THE UNITED STATES, 1921-1926

Kind	1921		1922		1923	
	Pounds	Value	Pounds	Value	Pounds	Value
Unmanufactured[a]	328,444	$ 331,219	385,653	$ 359,793	1,044,366	$ 532,375
Cut and split[b]	(c)	758,521	(c)	d555,243	(d)	(d)
Ground	134,650	2,166	313,745	4,514	1,867,385	28,324
Cut mica (dimension sheets)	(f)	(f)	e42,4579	e18,372	60,135	49,268
Splittings			e1,063,306	e371,801	4,301,727	1,730,532
Built-up mica boards, cups, tubes, and mica plates			e1,807	e2,860	30,032	37,382
Washers			e2,562	e675	20,164	6,776
Other manufactures			e7,842	e17,364	7,044	20,191
		$1,091,906		$1,330,622	7,330,853	$2,404,848

Kind	1924		1925		1926	
	Pounds	Value	Pounds	Value	Pounds	Value
Unmanufactured[a]	671,793	$ 419,154	604,550	$ 526,292	818,381	$ 562,300
Cut and split[b]	(d)	(d)	(d)	(d)		
Ground	1,342,107	22,034	950,614	13,120	140,732	2,048
Cut mica (dimension sheets)	74,534	69,018	41,284	63,466	46,662	44,621
Splittings	3,619,229	1,681,774	3,239,554	1,113,202	5,229,858	1,750,434
Built-up mica boards, cups, tubes, and mica plates	18,205	41,455	14,639	16,785	15,147	15,410
Washers	18,517	5,325	222	50	4,620	1,723
Other manufactuers	56,766	88,146	50,445	65,912	62,696	74,298
	5,801,151	$2,326,906	4,901,308	1,798,827	6,318,096	$2,450,834

a—Essentially uncut trimmed sheets.
b—Includes the Madras square-shaped uncut sheets.
c—Quantities not recorded prior to change in tariff, Sept. 22, 1922.
d—Classification discontinued with change in tariff and items shown separately.
e—September 22 to December 31.
f—Not separately classified prior to Sept. 22, 1922.

face of the water. Air separation has also been used to recover mica from its associated gangue minerals. At present only small amounts of schist are used for producing scrap mica, but it is expected that in the future this material will be of increasing importance as a source of mica for this purpose.

Mica schist is also employed as a refractory. It is quarried in eastern Pennsylvania and marketed to the metallurgical industries. For this purpose it is broken into blocks which may be laid like brick. The principal use is in bottoms for Bessemer converters and in lining cupolas. It is also used for lining lime kilns. It finds some use as structural stone. Due to its schistose structure, it commonly possesses a parting which makes separation possible into thin slabs which may be employed for coping and roofing.

The approximate average value for dry-ground mica in 1925, as indicated by the table, was 2 cents a pound ($40 a short ton), and for wet-ground mica 6 cents a pound ($120 a ton).

Statistics of Production

The production and imports of mica are given in the tables appearing on this page.

MICA SOLD BY PRODUCERS IN THE UNITED STATES, 1916-1925

	Sheet Mica[a]		Scrap Mica		Total[a]	
Year	Pounds	Value	Short Tons	Value	Short Tons	Value
1916	865,863	$524,485	4,433	$ 69,906	4,866	$594,391
1917	1,276,533	753,874	3,429	52,908	4,067	806,782
1918	1,644,200	731,810	2,292	33,130	3,114	764,940
1919	1,545,709	483,567	3,258	58,084	4,031	541,651
1920	1,683,480	546,972	5,723	167,017	6,565	713,989
1921	741,845	118,513	2,577	56,849	2,948	175,362
1922	1,077,968	194,301	b6,641	114,045	b7,180	308,346
1923	2,063,179	311,180	b8,054	129,695	b9,086	440,875
1924	1,460,897	212,035	4,709	87,242	5,439	299,277
1925	1,793,865	321,962	9,695	173,537	10,592	495,499

a—For 1920 and later years the figures for sheet mica represent uncut sheet exclusively; for earlier years some cut sheet was included.
b—Includes mica derived from mica schist.

Mica in Foreign Countries

India produces approximately 70 per cent of the world's supply of sheet mica. Its dominant position in the mica industry is maintained by its large reserves of mica of good quality and an unfailing supply of cheap labor. The principal producing areas are in the Nellorex district of the Madras Presidency and the Hazaribagh district in the Province of Bihar and Orissa. The latter district is the larger producer. Mining is still done in a very crude manner. The small mines use hand drills and pumps and either have coolies carry the

mica to the surface on their heads or use 8 or 10 coolies pulling a long rope, hoisting the mica to the surface in this manner. The larger mines are better equipped, using electric light for illumination, air drills, and gasoline or steam hoists for the recovery of the mica. The mica is thumb-trimmed at the mines, then sickle-trimmed at the factory. The mica is again trimmed with a knife by a sorter who cuts out cracks and imperfections and then sorts the mica into its various grades. Block mica is classified as either exportable block or splitting block. Exportable mica designates the mica of quality good enough for export to the market for use as sheet goods. Splitting mica is suitable for the manufacture of splittings. For splitting purposes the most desirable mica is the soft ruby. Hard or brittle mica is difficult to split and therefore is objectionable for splittings. Many of the splitters begin work in childhood and acquire a high degree of skill. Considerable mica is shipped from other parts of the world to India for splitting. In Madras much of the mica is recovered from open quarries. Probably 90 per cent of the mica from this district is square or rectangular trimmed. This is a good form of trimming for the ultimate consumer but involves considerable waste at the mine. The rainy season extending from June to September causes trouble and floods many of the workings. The reserves of mica in India are believed to be large and that country is expected to be a very important producer of mica for an indefinite period.

The occurrence of mica in Canada has been mentioned under the description of phlogopite mica. The largest mine is located at Sydenham, Frontenac County, Ontario. This mine is operated systematically and is equipped with modern machines for the breaking and removal of the rock. Increasing competition from Madagascar mica has tended to lower the production of mica in Canada. Production and exports are given in the following table:

The development of the mica deposits in Madagascar was due largely to the impossibility of securing adequate supplies of mica during the war years when normal commerce in this mineral was greatly impeded. The first exploration work in 1918 disclosed large quantities of mica of good quality which was suitable for most commercial uses and was particularly desirable in that most of the production was amber mica (phlogopite). Prior to that time Canada was the only country in which this variety of mica could be obtained in quantity, and the entrance of Madagascar as a producer was the first competition which the Canadian mines had encountered in the markets for this special mica. The quantity and value of the mica mined in Madagascar has increased steadily every year since operations were begun. The principal deposits are located in the region of Fort Dauphin in deposits similar to the Canadian in that the associated minerals are pyroxene and calcite. Development of the deposits has been hindered by aridity of the country in which they occur. Exhaustion of the surface deposits from which the mica could be easily recovered is making it necessary to resort to underground mining. Production in 1926 exceeded all previous years. Shortage of labor and poor transportation have impeded the development of the industry.

Although the mining of mica in South Africa is a comparatively unimportant industry, it is showing a constant increase and the output of the past year was markedly higher than the year preceding. Improvements in grading sheet mica and the exportation of scrap mica to the United States for grinding have broadened the markets for this district. Nearly all of the mica is found in the Leysdorp field along the northern bank of the Olifants River. Mica Siding on the Selati Railroad serves as a shipping point for most of the mines which are located within 50 miles of this point. Shipments are made by rail direct to Lourenço Marques,

STATISTICS OF MICA IN CANADA

	Production		Exports	
	Short Tons	Value	Pounds	Value
1918	747	$271,550	866,000	$410,000
1919	2,754	273,788	5,482,000	641,962
1920	2,203	376,022	6,606,000	815,633
1921	706	76,773	2,228,000	220,482
1922	3,349	152,263	7,666,000	464,512
1923	3,525	326,974	10,884,000	757,276
1924	4,091	357,272	9,784,000	543,966
1925	4,020	261,463	10,500,000	411,310
1926	2,451	222,825	.....	499,242

PRODUCTION OF MICA IN CANADA, 1926

Grade	Pounds Quantity	1926 Value F. O. B. Shipping Pt.	Price per Pound
Rough-cobbed	109,880	$ 11,724	$0.106
Thumb-trimmed	321,028	63,919	0.199
Splittings	182,214	121,542	0.667
Scrap	4,288,720	25,640	0.006
Total	4,901,842	$222,825	$0.045

EXPORTS OF MICA FROM CANADA, 1924-1926

	1924		1925		1926	
	Tons	Value	Tons	Value	Tons	Value
Rough-cobbed and thumb-trimmed	88	$ 52,527	29	$ 21,366	44	$ 20,516
Mica splittings	285	424,503	230	324,967	315	432,345
Mica, scrap and waste	4,519	63,610	4,991	63,931	3,799	45,297
Mica, plate and manufactures of (micanite)	....	3,326	....	1,046	....	1,084
Total	....	$543,966	....	$411,310	....	$499,242

the nearest seaport. The amount of salable mica which can be recovered from one ton of ore is so small that it has been found that the recovery of one ton of marketable mica involved the mining and handling of 1400 to 1600 tons of rock. An increased production is expected from this district.

The mica mines in Rhodesia are small and scattered over an area so remote from railroad transportation that only the most valuable sheet material may be exported with profit. Ruby mica of excellent quality is produced in small tonnages. The heavy rains in the early part of 1925 were very troublesome and flooded many of the workings. Pumping by man power and the operation of whips driven by oxen were employed for the removal of water.

The dark green and brown muscovite mica found in Tanganyika Territory is of excellent quality and suitable for the highest grade of electrical work. Mining was active in 1925 and 1926 and an increased production is expected. The quality of the mica together with the location of the deposits, which are fairly accessible, indicate that this district will become an important source of the world's mica.

The deposits of mica in South and Central America are known to be large and capable of producing mica of good quality. At present railroad facilities are lacking in the vicinity of many of the mines and development is dependent upon improved transportation. Absence of a local market for mica scrap and low-grade material is a further handicap, as only high-grade sheet mica has sufficient value to justify its transportation. At present active production is limited to Argentina, Brazil, and Guatemala.

The value of the mica mined in these countries is showing a small but steady increase. The following table of general imports of mica to the United States from these countries in 1926 indicates the development of the industry, as most of the production is consumed in this country.

UNITED STATES IMPORTS OF MICA FROM SOUTH AND CENTRAL AMERICA, 1926

	Unmanufactured		Cut, Split and Manufactured	
Source	Pounds	Value	Pounds	Value
Argentina	100,347	$63,212	.....	.....
Brazil	52,646	48,330	33	$ 55
Guatemala	5,908	6,834	16,357	7,718

Mica was mined in Bolivia during 1925 for the first time, and a few hundred pounds of selected sheets were prepared for shipment to the United States to determine their commercial value. Mica has been produced in several other countries, especially Australia, Ceylon, Costa Rica, Chile, Mexico, Norway, Russia, and China. The total production from these countries is not an important factor in the world's markets; but it is of interest in indicating sources from which a future production may be expected with the development of new markets, or the construction of transportation facilities that will make possible the exploitation of areas not accessible at present. It has been reported that the mica deposits of Siberia have been leased and that they will be operated actively. Before the war the Siberian deposits supplied 50 per cent of the demands of Russia and it is possible that they may be developed sufficiently to produce a surplus for export.

Tariff

The import duty on mica as fixed by the tariff act of September 22, 1922, paragraph 208, is as follows: Mica, unmanufactured, valued at not above 15 cents per pound, 4 cents per pound, valued above 15 cents per pound, 25 per cent ad valorem; mica, cut or trimmed, and mica splittings, 30 per cent ad valorem; mica plates, and built-up mica, and all manufactures of mica or of which mica is the component material of chief value, 40 per cent ad valorem; ground mica, 20 per cent ad valorem.

Fire Losses Being Reduced

For the first half of 1927, the fire losses in the United States have been estimated to be 177 million dollars. This is a reduction of 23 per cent compared with last year during the same period.

Microbes Produce Copper

Copper is ordinarily thought of as one of our most valuable metals won from the earth through the skill of the miner and made into usable form by the metallurgist; but according to a recent report of the Department of the Interior, it now appears that metallic copper may be deposited—in relatively small quantities to be sure—through the action of bacteria.

During a survey of the region near Cooke, Montana, by the Geological Survey, spongy masses of native copper were found in the black muck of a bog. Several bodies of pyritic copper ore crop out about half a mile above the bog. This ore weathers rapidly, and the copper is removed from it in solution as cupric sulphate. Redeposition of the copper as native metal only in the black muck and in none of the gravels and sands in the vicinity was ample proof that something in the muck had caused the precipitation of metallic copper from the sulphate solution, but the identity of the precipitating agent remained to be determined. Consideration of inorganic processes was discouraging, but preliminary experiments with the copper-bearing muck led to more carefully controlled experiments which proved beyond question that the copper was precipitated through the agency of certain bacilli.

PIT AND QUARRY FOREIGN DIGEST

Rapid Hardening Cement for Piles

Rapid hardening cement is now being marketed in all parts of the world. Illustration 1 shows piles made with rapid hardening cement to be used for the foundation of the Stanley Street bridge, which is to link up South Townsville, Australia, with the railroad freight terminal in Townsville. There are 48 of these piles, of which 43 are 14 inches square and vary in length from 39 to 50 feet, and the remaining five are 16 inches square. The curing time was one-half that required for ordinary portland cement.—Anon. (The Structural Engineer, July 1927, p. 256.)

New Apparatus for Testing Plaster

This apparatus is shown in cross section in Figure 2 and in perspective in Figure 3. It consists of a brass container A, in the shape of a truncated

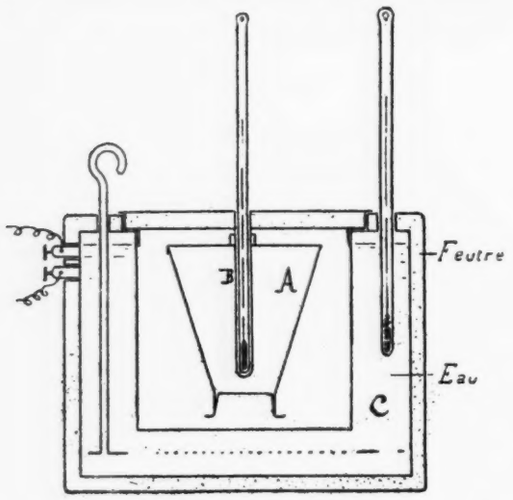


Fig. 2 Cross-Section of Apparatus for Testing Plaster

cone in which is placed the plaster mixture to be tested. A metallic thermometer tube B is held in place by a stopper in the cover of the receptacle. Any desired temperature is maintained in the water bath C by means of electric heating, and the whole apparatus is insulated by felt. To use this apparatus, the entire interior surface of the container A is greased to facilitate the removal of the hardened plaster. 180 cc. of water, which has reached room temperature, are placed in the container A, and the vessel is placed in the "setting meter." Vaseline oil is placed in the thermometer well B, and the cover set in place with the thermometer. The water bath C is filled with water at the same temperature as that in A. The temperatures of the water in A and C are now noted. The cover of A is removed and 300 gms. of plaster are added to the water in the small vessel and rapidly mixed to a homogeneous paste. The rise in temperature is noted and plotted as a function of the time elapsed. The temperature of the water bath is raised to keep it equal with the temperature of the plaster. The form of the curves re-

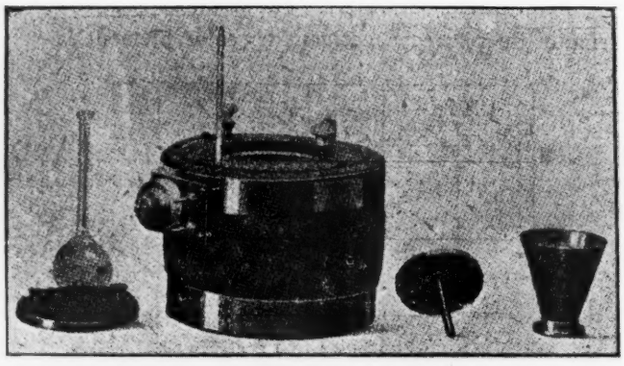
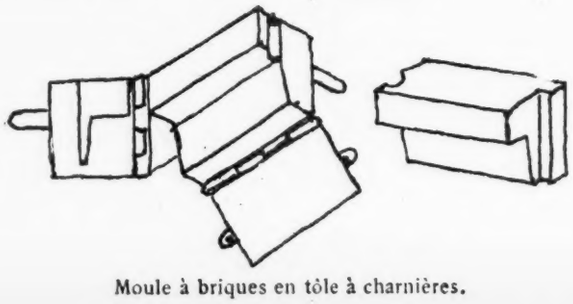


Figure 3

sulting indicates the variety and properties of the plaster.—Jolibois & Chassevent (Poulenc Freres)—(Le Ciment, July, 1927, pp. 246-248.)

Refractory Cement

Refractory concrete is made by using ground and crushed pieces of refractory bricks as aggregate. The crushed material is carefully sieved on screens of about 6 meshes to the inch. It is then mixed as intimately as possible with aluminous cement in a proportion by volume of 1 part cement to 2-3 parts refractory aggregate. The total is mixed with about 20 per cent water. A true concrete is thus obtained, which may be molded or cast and which sets and hardens. The setting is rapid and no shrinkage occurs on cooling. The molds may be removed almost immediately. The hardening is complete in about three or four hours. The concrete retains its strength at sufficient elevated temperatures to replace advantageously, in a number of cases, refractory bricks themselves. From the economic viewpoint, if the refractory waste material which makes up the aggregate is considered to have no market value, the cost of the refractory concrete is less than the average of that of the aluminous-silica brick refractories. A mold of refractory concrete on hinged sheet-iron plates is illustrated in Figure 4.—P. Jarrier (Chaleur et Industrie, and Le Ciment, July, 1927).



Moule à briques en tôle à charnières.

New Dutch Cement Definitions

1. Portland cement must have a hydraulic modulus not less than 1.7. The materials must be intimately mixed under constant chemical control and burned to the sintering point and finely ground.

2. Aluminous cement (Alzement) is a hydraulic mortar which is a finely ground product resulting from the fusion of materials containing lime with substances of high alumina content.

3. Iron portland cement is a hydraulic mortar which consists of a minimum of 70 per cent of portland cement ground with granulated basic blast furnace slag. Blast furnace slag and portland cement clinker are ground together and intimately mixed. The composition of the slag used must correspond to the following relation:

$$\frac{CaO + MgO}{SiO_2 + Al_2O_3} > 1.$$

4. Blast furnace cement is a hydraulic mortar which has a minimum of 15 per cent portland cement mixed with granulated basic blast furnace slag. The slag must have the composition indicated herewith:

$$\frac{CaO + MgO + \frac{1}{3} Al_2O_3}{SiO_2 + \frac{2}{3} Al_2O_3} > 1.$$

5. Natural cement is a hydraulic mortar, composition similar to portland cement, but which occurs in nature. The raw material is burned to sintering and ground with or without a substance to regulate its setting time.

6. Slag cement is a hydraulic mortar obtained by grinding an intimate mixture of granulated basic furnace slag and dry, slaked, fat or hydraulic lime.

7. Cement-lime is a hydraulic mortar found in nature, burned without sintering.—Anon. (Zement, July 7, 1927).

Calcium Chloride on Cements

The product on the market called "X," for addition to cements, consists of a solution in water of about 38 per cent calcium chloride. Tests for cracking were made with neat cement with and without the use of "X," nine mixes being made of each, and all of them being cured in water at 15 degrees C. Three of the nine made with pure water showed cracks after several days, while those mixed with the calcium chloride solution were intact after the same interval. The pats made with varying concentrations of the calcium salt showed no trace of efflorescence, but on the contrary, those with the largest amounts of calcium chloride were constantly moist, due to the hygroscopic character of the salt. The addition of calcium chloride accelerates the setting of all cements, considerably for aluminous, "Holderbank" and standard portland cements, but much less for slag cement. Concentrated solutions are not recommended because the setting time is made too short. Addition of the calcium salt has a markedly unfavorable effect on the hardening of slag cement and aluminous cement, little influence on "Holderbank" and a favorable effect on portland. The use of calcium chloride might prove valuable in some cases in cold weather, but more investigation is necessary before employing a strange material.—M. Anstett

Influence of Lime Upon Soil Life

Proper addition of lime to the ground promotes the activity of the useful soil bacteria. It increases the fermentation power and raises the amount of nitrogen fixation from the air. The decomposition of humus is favorably influenced. In short, liming the soil has a decidedly beneficial effect upon agriculture.—T. Remy (Meeting German Agricultural Society and Society of German Lime Producers, May 25, 1927).

Lime and German Agriculture

Lime plays an important role in irrigation regulation, the liquefaction of sewerage, the mixing with soil and especially in breeding of animals with the help of food rich in lime instead of expensive feeding materials. Decreased amount of weeds, earlier warming, greater firmness of soil, and easier plowing and harvesting work result from the use of lime. Lime takes its place alongside of animal fertilizers and careful cultivating methods as an essential aid to increasing yield of agricultural products.—W. Büsselberg (German Agricultural Society Meeting, May 25, 1927).

Cement and Trass Analysis

The ratio of the lime content to that of silicic acid, alumina and iron oxide together is called the hydraulic modulus of the cement. This must not be less than 1.8 with portland cement. The ratio of the silica acid content to the sum of the other constituents is called the silicate modulus. This varies in commercial portland cements from 1.2 and 4.0. Moisture is determined by drying on a water bath below the boiling point. Carbon dioxide is estimated by ignition without fusion. Sand and clay are determined by treatment first with HCl and then NaOH, and weighing the residue.—H. Bach (Zement, July 7, 1927, pp. 563-566).

Silicating and Fluorizing Concrete

Painting concrete with water glass (silicating) does not afford protection against acids, as is the case with salts of fluorsilicic acid. The solubilities in acids of the corresponding calcium compounds and cements treated therewith are being investigated. P. Mecke (Tonind.-Ztg., Vol. 51, pp. 703-705).

Comparison of the Relative Economy of Cooking and Kiln Processes in Burning Plaster of Paris

The cooking process involves the disintegration at the factory of the raw gypsum. It is first crushed in a rough disintegrator and then ground in a mill to a fine powder. This grinding is accompanied by a large power consumption, and a high cost which can be referred to the water of crystallization as well as the surface water in the crude gypsum. Up to this point the operation is con-

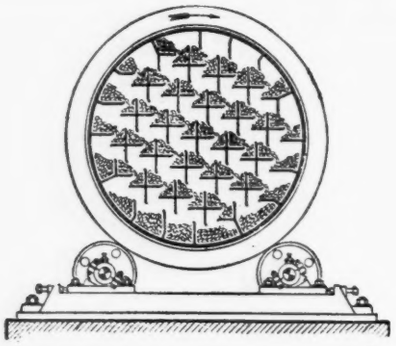


Fig. 1. Cross Section of Rotary Kiln

tinuous. The burning or cooking is a periodic process involving much hand labor. The ground raw gypsum is burned in a cooking kettle with indirect heating by the hot gases of the coal fire. The gypsum bubbles, and the heating is continued until the water content decreases to 3-4 per cent. The kettle is emptied by hand. The filling and emptying periods are unproductive. The cooking process is dependent upon the skill and care of the oper-

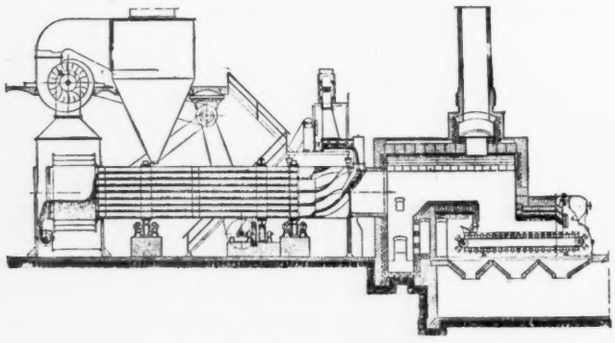


Fig. 2. Showing Entire Cooking Installation

ators for its success, for the burning must not be carried too far as the product then obtained will not set. It sometimes happens that parts of a charge will be dead-burned and other parts will not be sufficiently dehydrated owing to lack of uniformity in the process. A rotary oven for plaster of Paris burning has been devised in Germany which eliminates these difficulties. Figure 1 shows the cross section. Figure 2 shows the entire installation. The raw gypsum reduced to the size of hazel nuts is introduced through a charging funnel and is carried through the oven and meets the heating gases in direct contact. The temperature of the exhaust gases is only slightly above that of the necessary temperature of the gypsum, so that the heat loss is kept at a minimum. The burned material is discharged onto a special transporting device and the dust carried by the exhaust gas is removed in a dust collector. The dust can be used without further treatment. The pulverization of the burned product is much less expensive than pulverizing the crude gypsum. The operation is completely continuous and automatic. The coal saving is 30 per cent of that required by the cooking methods. B. Sägebarth (Chemiker-Zeitung, August 3, 1927, pp. 588-589).

Device for Application to Cement, Lime, Etc., Burning

In the burning space f, (Figure 6) of the oven, the chamotte tubes O are built in. In the interior the iron pipes p are set and are supported through-

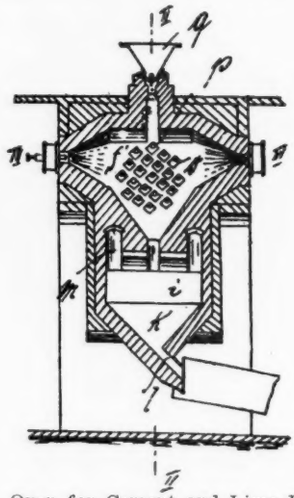


Fig. 6. Oven for Cement and Lime Burning

out their entire length by the chamotte tubes. Water flows through the iron pipes and air through the chamotte tubes. The air is used for combustion after this passage. The heated water can also be used industrially. The dust forming burned product such as marl, mixed with clay, is introduced into the funnel q, and dusted over the burning zone by a special device, so that it first falls freely in the burning zone. It then falls on the tubes O, on which the dust particles sinter together, and thus slide off the sloping surfaces of the prismatic tubes, whose edges are open. The rods o are hollow, fireproof of square cross-section with one edge open through which cooling air passes. Ernst Meier (German Patent Application No. M.87,763).

Crushers With Vibrating Jaws

A machine for crushing ores, stone, rock, etc., comprises a three-sided frame with a pivoted jaw mounted therein and forming the fourth side; a

shaft with eccentrics thereon mounted outside the frame in front of the fixed jaws; one or more beams suspended outside the frame parallel with the shaft and connected with the movable jaw; and toggle mechanism connected with the beam or beams and operated by the eccentrics. The movable jaw is carried by a shaft mounted in bearings in the two sidemembers. A beam disposed on the outer side of the front member of the frame and parallel with the driving-shaft is suspended from the upper part of the member by toggle mechanism operated by eccentrics on the shaft. A plate is seated at its ends in bearing in the member and beam respectively. Rods at or near the ends of the beam connect the beam to lubs on the jaw, the rods passing through holes in the beam and lugs. Each rod is secured in the beam by a nut engaging in a recess in the beam and locked by means of a bar which is secured at its ends to the beam and engages slots in the nut. The end of the rod that cooperates with a lub is spherical and engages a corresponding seating, a cap or cover retaining the end of the rod in place. In a modification two beams are used, one beam being suspended from the upper part of the member through adjustable springs and the other from the beam through toggle mechanism. The beams have pivotal connections with the frame through plates. C. Roscoe (British Patent 271, 799).

Flooding of Aluminous Cement

Aluminous cement was mixed with 26, 30, 35, etc., up to 75 per cent distilled water and allowed to harden in the following manners: (a) in corked bottles entirely filled with cement mixture; (b) in a desiccator over caustic soda; (c) in the air; (d) in a stream of carbon dioxide. The results obtained were (a) all tests were well hardened after 7 days. With water additions above 50 per cent, the excess water separated. The high water mixtures were first very thin, setting and hardening being much delayed. (b) Results similar to *a*. (c) The air dried parts were sandy and soft, especially the very wet mixtures. (d) The "sanding off" is very much greater than in (c), the very wet tests were entirely destroyed to a depth of 5 mm. Aluminous cement is unfavorably influenced by great excess of water and its setting and start of the hardening is retarded. Flooding in itself with an extension of the time of hardening is not to be feared so long as other unfavorable influences are avoided. Fresh aluminous cement is very sensitive to CO_2. O. Schmidt (Zement, July 28, 1927, pp. 640-641).

Cement Stone in Cast Concrete

(1) The best cement stone does not render cast concrete completely water-tight. A small absorption of water occurs at higher pressure, such as 3 atmospheres hydraulic pressure. (2) The water-tightness of the cement stone increases with increasing cement-water factor. (3) The impermeability to water of the concrete increases in the same manner. (4) Concrete plates which do not fulfill the law:

$$\frac{Zm + Fm}{Wm} = 0.9$$

Zm = cement mass. Fm = fine aggregate. Wm = amount of water.

which contain large water pores are more permeable to water than concrete plates without large water pores but of the same cement-water factor. Gaze (Beton u. Eisen, July 20, 1927, pp. 270-273).

Pure Quartz Sand and Silica Glass

In the production of opaque silica glass by fusion of pure siliceous sand in the electric furnace with carbon electrodes, the melt may become contaminated with free silicon which is produced by reduction at a temperature below that of fusion (1800 degrees). This is prevented by the use of perforated tubular electrodes which enable the vapor to be removed, by a tube of molten silica around the electrode, or by the presence in the sand of about 2 per cent of water to oxidize the silicon vapor to silica. Except from a thermal point of view the last method produces a superior product. H. George (Compt. rend., 1927 184, 1046-1047, and B. A., July 8, 1927, p. 483).

Composition of Alite

Törnebohm's analysis of alite, the characteristic constituent of cement clinker:

SiO_2	-	19.48%	MgO	-	3.00%
Al_2O_3	-	7.83%	Na_2O	-	0.90%
CaO	-	67.60%	K_2O	-	1.19%

is questioned because of the doubtful assumption that the clinker was contaminated with 10% of Celite. It gives, however, a good idea of the composition. If Törnebohm had used a microscope he would have identified alite of tricalcium silicate. O. Schmidt (Zement, July 28, 1927, p. 641).

Aluminous Cement

A rotary kiln is used for the manufacture of fused aluminous cement which has openings at the hottest part through which the molten cement mass discharges, and which is shaped like a cone at the hotter end. This arrangement retards the formation of ring shaped crusts in the interior of the kiln and reduces the tendency of the fluid cement to injure the kiln walls. British Portland Cement Manufacturers, Ltd. (French Patent 618, 232).

INTIMATE NEWS OF MEN AND PLANTS

Lime Companies Merge

The United States Lime Products Company is the new name of the merged interests formerly operating separately as the Nevada Lime and Rock Corporation and the Pacific Lime and Plaster Company. Assets in excess of $2,000,000 are reported to be involved in this transaction.

Charles M. Cadman, president of the Pacific Lime and Plaster Company, is to become president and general manager of the new company, and H. S. Gillies, resident manager of the Pacific Lime and Plaster Company, and J. G. McGinnis, vice-president and general manager of the Nevada Lime and Rock Corporation, will represent the new company in Southern California. The building of a large new warehouse for the new company in the city of Los Angeles is contemplated.

County Highway Officials Plan Organization

The executive committee of the newly organized County Highway Officials' Division of the American Road Builders' Association held its first meeting on July 25 in the office of President Wassor, Jersey City, N. J., and in addition to formulating by-laws to be presented to the board of directors at its next meeting, mapped out a program for the ensuing year.

A part of the plan of organization is to have county contact men, or a representative of the division appointed from each county who would serve as the contact between the division and the county and who would be the official delegate to the annual convention.

Eight committees were appointed and other committees will be added from time to time. The committees and their chairmen are as follows: Surveys and planning, Stanley Abel, chairman; county highway construction, Chas. E. Grubb, chairman; rural county highway maintenance, E. B. Wilkes, chairman; urban county highway maintenance, Geo. A. Quinlan, chairman; county highway legislation, H. B. Keasbey, chairman; county administration, Chas. A. Browne, chairman; construction and maintenance equipment, E. L. Gates, chairman; county highway finance, John McHugh, chairman.

The reports of the committees will form the basis of a paper that is to be presented by the chairman, or someone appointed to represent the committee, on County Highway Officials' Day at the convention and road show of the American Road Builders' Association which will be held in Cleveland, Ohio, January 9-13, 1928.

Superior Cement Completes Research Laboratory

The superior Cement Company, according to a report from Ironton, Ohio, has completed the construction of a research and experimental laboratory. It is located near the company's chemical laboratory and will be used for the special purpose of furthering the new Wifco product which the Superior plant has recently introduced—a prepared colored mortar on which the company holds a patent and which is said to have gained considerable notice from builders.

The new laboratory displays in its outward structure the various colors of Wifco cements, with a special color design for the porch. The interior is also worked in the Wifco colors, and the floors of this are also laid in special color designs.

Did It Pay Sandy Pratt?

Clarence (Sandy) Pratt, president of the Pratt Building Material Company and the Pratt Rock and Gravel Company, used a novel way of announcing the opening of his company's large sand and rock bunkers on Berry street by advertising in the newspapers that the first truck belonging to a plasterer, to a brick contractor, to a building material dealer, to a concrete contractor, to a general contractor, etc., that arrived at the Pratt Company, San Francisco, bunkers on Monday, August 8, would receive a free load of sand, rock, gravel or concrete mix. A large truck, even a hayrack or moving van was suggested in Sandy's newspaper story.

Seven-thirty a. m. was the time set for the grand opening and the distribution of free sand and rock. The first truckman arrived at 6 a. m. with new sideboards on his truck and waited until 7:30. When his load of sand was weighed, it showed that the "early bird" had "caught" 18,660 pounds or 9.33 tons of free sand. The driver said he read Mr. Pratt's ad in the paper which said: "Bring a big truck." In all, 17 trucks of all makes and all sizes, some with home made enlarged bodies lined up for a load of free sand or rock. The line of trucks extended down Berry street for a block and while the Pratt Company advertise that their bunkers are the largest in Northern California, the 17 trucks almost cleaned the bunkers and a hurry-up call was sent to the Pratt plants at Sacramento, Marysville, Prattrock (near Folsom), Prattco (Monterey County) and Mayhew (Sacramento County) for more material to arrive by special train if possible.

Sandy Pratt, as he is best known, believes in newspaper advertising but did not fully realize its real value until 17 large trucks walked away with his sand and rock which filled his "mammoth" bunkers. Sandy will continue to advertise his sand and rock that is to be sold, but no more press notices about free material.

Finishing Lime Association Opens New Offices

According to a report from Toledo, Ohio, the Finishing Lime Association of Ohio has opened offices in that city at 508-9 Home Bank Building, with L. E. Johnson, secretary and general manager, in charge.

The association will conduct a national work with district offices in several of the large cities. Toledo will be headquarters due to its location near the center of the world's greatest producing district for hydrated lime. Fred Witmer of the Ohio Hydrate and Supply Company, Woodville, is president of the association and G. H. Faist of the Woodville Lime Products Company, Toledo, is the treasurer.

Merger of Indiana Companies

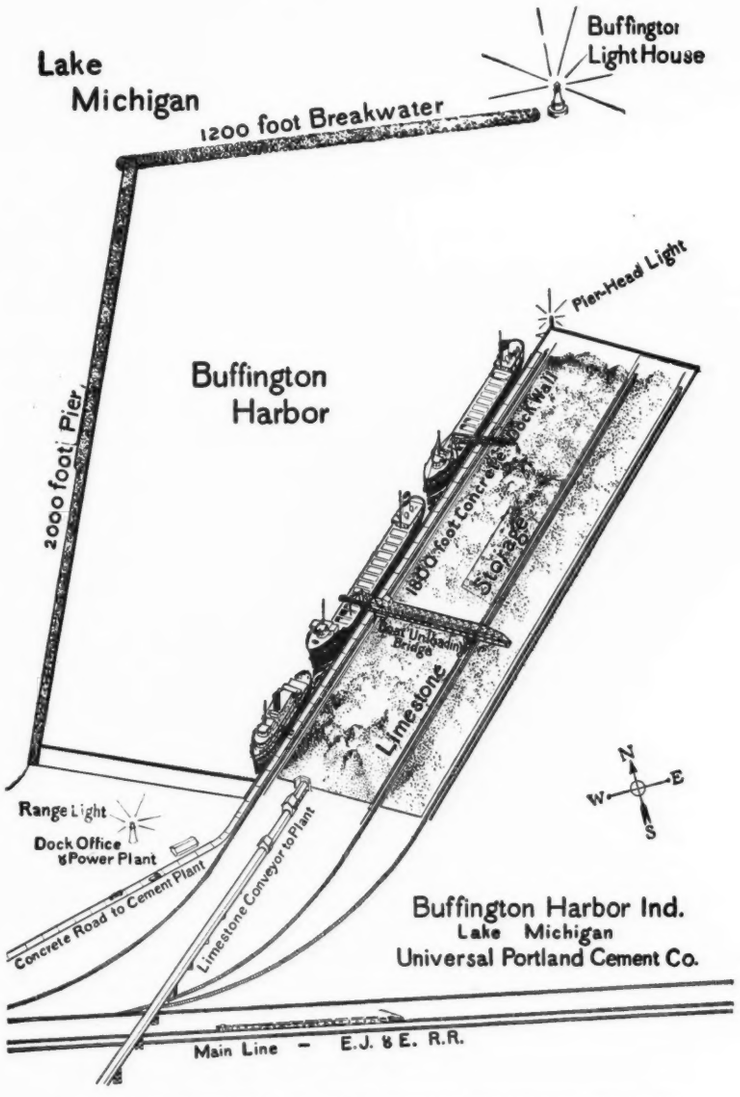
Plans for the merger of approximately thirty Indiana limestone companies, representing an investment of between thirty and forty million dollars, were disclosed recently by C. H. Webb, vice-president of the Indianapolis Oolitic Stone Company.

Purchase of the entire control of the companies is contemplated by the George M. Foreman Company, investment bankers of Chicago. About twenty independent companies, representing two-thirds of the remaining independent organizations in the Bedford-Bloomington district already have accepted the proposal and the merger will probably be completed in the next thirty or sixty days.

Engineers Inspect New Harbor of Universal Portland

With over a thousand architects, engineers, contractors, dealers, public officials and others in attendance and with the Engineers Society of Milwaukee, the American Society of Civil Engineers, the American Institute of Architects and other leading organizations in the construction field represented, the Western Society of Engineers on August 17, conducted the largest inspection trip in its 58 years' history when a specially chartered steamer carried members and guests from the Municipal Pier, Chicago, to inspect Buffington Harbor, the new deep-water harbor at the Chicago plant of the Universal Portland Cement Company.

The inspection party was headed by Major Rufus W. Putnam, president of the Western Society, former United States Engineer for the Chicago district and now chief engineer of the Harbor Plan of Chicago, and B. F. Affleck, president of the Universal Company which built and owns the new harbor. Following their arrival at Buffington, members of the Western Society and guests inspected the 55-acre harbor basin, the million-ton storage yard for limestone and coal, the 1200-foot breakwater and the concrete dock 1,800 feet long and 600 feet wide. They witnessed operation of one of the largest boat-unloading bridges in the Middle West and saw a concrete-enclosed conveyor carry stone from dock to cement plant at the rate of 6 tons per minute. The program included a trip through the Chicago plant of the Universal Company.



Layout of Universal Portland Cement Company's Facilities at Buffington Harbor, Ind.

The harbor was designed and its construction supervised by the engineering department of the Universal Portland Cement Company. The dredging, pile driving and concrete work were done by the Great Lakes Dredge and Dock Company. The traveling bridge was designed and built by Mead Morrison Manufacturing Company and American Bridge Company, and the conveying system by Robins Conveying Belt Company.

Companies Give Employees Group Insurance

Five hundred employees of the Grey Knox Marble Company, of Knoxville, Tennessee, have accepted their employer's offer of group insurance providing more than $75,000 of life insurance protection. The amount of life insurance each employee receives is determined by his position and ranges from $1,000 to $5,000. A group insurance program, establishing more than $175,000 of life insurance, and liberal sick and accident benefits has also been adopted by the Knoxville Marble Company, of Knoxville, Tennessee, for the benefit of its employees.

By a cooperative arrangement, the employer and employees will jointly pay the premiums. Based on position occupied, the schedule of insurance provides each contributing employee with life insurance ranging from $500 to $3,000, while under the terms of the health and non-occupational accident policy, weekly benefits of $10 to $30 will be paid for each case of disability covered. Payments wil continue for a maximum of 26 consecutive weeks.

Carbon Limestone Installs Largest Casting Shovel

The Carbon Limestone Company have completely installed at their Hillsville (Pa.) quarry the largest casting shovel for removing overburden from limestone that has been invented. This shovel is in reality the largest casting shovel in any quarry in the world today. It has a ninety foot boom equipped with an 8 yard bucket which will remove the overburden and cast it in a pit far removed from the working operations. The shovel has a capacity of 5,000 cubic yards per day. The Marion Steam Shovel Company manufactured the shovel. A public demonstration of the equipment in operation was given on August 24. Luncheon and refreshments were served at noon.

Texas Wants State Cement Plant

A conference was recently held in Austin, Texas, regarding the advisability of establishing a state cement manufacturing plant to provide materials for the construction of state highways.

Sales of Slate in 1926

The value of the slate sold at the quarries of the United States in 1926 was $12,352,767, according to figures furnished by producers to the United States Bureau of Mines, Department of Commerce. This was 2 per cent less than the value reported for 1925. The quantity sold was approximately 718,000 tons, 1 per cent less than in 1925. The roofing slate sold amounted to 465,900 squares, valued at $5,079,087, a decrease of 6 per cent in quantity, but practically the same value as in 1925. The average value per square increased from $10.28 in 1925 to $10.90 in 1926. The total sales of mill stock amounted to 10,278,130 square feet, valued at $4,191,185, a decrease of 7 per cent in quantity and 1 per cent in value.

Structural slate—2,590,340 square feet, valued at $988,521—increased 11 per cent in quantity; electrical slate —1,857,940 square feet, valued at $1,537,034, increased 12 per cent in quantity; slate for billiard-table tops,

Slate sold by producers in the United States in 1926, by States and uses.

State	Operators	Roofing Squares (100 sq. ft.)	Roofing Value	Mill stock Square test	Mill stock Value	Other uses (value)[1]	Total value
Arkansas	1	.....	.....	.....	.....	(2)	(2)
California	3	.....	.....	.....	.....	$ 2,976	$ 2,976
Georgia	1	.....	.....	.....	.....	(2)	(2)
Maine	3	(2)	(2)	(2)	(2)	(2)	662,184
Maryland	3	(2)	(2)	(2)	(2)	(2)	207,989
New York	17	11,093	$ 177,455	.....	.....	736,359	913,814
Pennsylvania	43	263,668	2,127,782	8,645,980	$ 2,842,182	443,213	5,413,177
Tennessee	1	.....	.....	.....	.....	(2)	(2)
Vermont	46	148,926	2,310,410	1,011,370	768,178	1,188,453	4,267,041
Virginia	4	31,172	331,651	.....	.....	(2)	(2)
Undistributed		11,041	131,789	620,780	580,825	711,494	885,586
	122	465,900	$ 5,079,087	10,278,130	$ 4,191,185	3,082,495	$12,352,767

[1]Chiefly slate granules. [2]Included under "Undistributed."

Distribution of slate products in 1926, grouped by destination territories.

District	Roofing (squares)	Structural and sanitary (sq. ft.)	Electrical (sq. ft.)	Vaults and covers (sq. ft.)	Blackboards and bulletin boards (sq. ft.)	Billiard tables (sq. ft.)	Floors and walks (sq. ft.)	Granules and flour (tons)
Connecticut Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	36,000	299,000	279,000	92,000	241,000	1,400	12,000	33,500
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	198,000	880,000	810,000	282,000	909,000	118,000	194,500	147,500
Illinois, Indiana, Michigan, Ohio	50,000	194,000	281,000	43,000	608,000	200,000	36,000	212,000
Florida, Georgia, North Carolina, South Carolina, Virginia	12,000	40,000	1,000	32,000	174,000	2,000	13,000	27,200
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	20,000	16,000	13,000	200	86,000	.....	500	14,400
Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska, Oklahoma, Texas, Wisconsin	16,000	72,000	63,000	10,000	429,000	36,000	....	12,000
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	3,000	20,000	7,000	.....	253,000	60	....	6,200
	335,000	1,521,000	1,454,000	459,200	2,691,000	357,460	256,000	452,800
Total sales	465,900	2,590,340	1,857,940	490,060	3,998,800	367,220	379,830	498,050

Roofing slate, mill stock[1], and slate granules sold in the United States in 1925 and 1926, by uses.

Use		1925 Quantity	1925 Value[2]	1926 Quantity	1926 Value[2]
Roofing	squares	494,530	$5,084,945	465,900	$5,079,087
Approximate short tons		166,000	.....	157,450	.....
Electrical	sq. feet	1,655,810	1,376,948	1,857,940	1,537,034
Approximate short tons		11,900	.....	13,350	.....
Structural and sanitary	sq. feet	2,332,700	862,019	2,590,340	988,521
Approximate short tons		16,700	.....	18,550	.....
Grave vaults and covers	sq. feet	523,850	125,582	490,060	130,882
Approximate short tons		7,500	.....	6,900	.....
Blackboards and bulletin boards	sq. feet	5,184,060	1,690,612	3,998,800	1,356,405
Approximate short tons		13,900	.....	10,700	.....
Billiard-table tops	sq. feet	341,440	140,498	367,220	145,457
Approximate short tons		2,500	.....	2,700	.....
School slates	pieces	1,944,320	35,818	1,820,820	32,886
Approximate square feet		1,040,000	.....	973,770	.....
Approximate short tons		1,400	.....	1,300	.....
Granules	short tons	497,700	3,210,904	498,050	3,009,368
Other	short tons (estimated)	7,000	48,000	9,000	73,127
Total (quantities approximate, in short tons)		724,600	$12,575,326	718,000	$12,352,767

[1]In 1925 the mill stock sold, including school slates, was 11,077,860 square feet, valued at $4,231,477; in 1926, 10,278,130 square feet, valued at $4,191,185.
[2]F.o.b. at point of shipment.

367,220 square feet, valued at $145,-457, increased 8 per cent. Slate used for flagstones, cross walks, stepping stones, etc., has shown increasing sales the last few years, and an increase of 35 per cent in the quantity sold in 1926 over that in 1925 was reported.

Sales of mill stock for blackboards 3,998,800 square feet, valued at $1,-356,405,—decreased 23 per cent in quantity in 1926. School slates and slate for vaults and covers also decreased in quantity of sales in 1926. The crushed slate sold for roofing granules and flour in 1926 was 498,-050 short tons, valued at $3,009,368, which was practically the same quantity as in 1925. The average value per ton was lower than in 1925.

The accompanying tables show the sales of slate by quarrymen in 1925 and 1926, by uses and by states. There is also given a table showing the shipments of the different slate products according to destination territories. The data in this table are not complete but represent such information as the Bureau of Mines has been able to compile, and is published to comply with many requests.

Ohio Valley Sand Company Purchase New Equipment

The Ohio Valley Sand Company of New Martinsville, West Virginia, will increase its capital to $200,000. The additional capital will be used for the purchase of new equipment which the directors have deemed necessary to take care of the increased business which the company has enjoyed this year.

Close Cement Plant

The United States Portland Cement Company's plant at Concrete, Colorado, is permanently shut down and will not reopen until the property can be sold and other adjustments made. The plant got into trouble with the government some time ago for alleged violation of the Sherman anti-trust act and was closed down by order of the Federal Court.

Northwestern Plant Progress

With the stack of the Northwestern Portland Cement Company's plant at Grotto, Washington, completed and the spur tracks laid, work is being rushed to put the plant into operation at an early date. The main plant building is already completed and ready for the installation of machinery, the crushing plant is under construction and the office building is under construction, according to latest advices.

Karch to Open New Quarry

The J. W. Karch Company of Celina, Ohio, has purchased a tract of land near Montpelier, Indiana, and plans to operate a stone crushing plant as soon as the necessary machinery can be purchased.

Duff Abrams Goes Abroad

In order to study recent developments in the manufacture and use of Portland cement abroad Professor Duff A. Abrams, Director of the Department of Research of the International Cement Corporation, sailed last week for Bremen aboard the United States Lines S. S. "George Washington."

He will represent the International Cement Corporation at the Fiftieth Anniversary of the Association of German Portland Cement manufacturers. This convention will be held at Berlin, August 28th to 31st and in addition to representing the International Cement Corporation, Professor Abrams will act as the official delegate of the American Portland Cement Association.

As a supplementary program of the convention visits will be made to German Cement Plants in the territory from Dessau to Heidelberg. The International Congress of Testing Materials will be held at Amsterdam, September 12th to 17th and at this meeting Professor Abrams will also do double duty. In addition to representing the International Cement Corporation he will act as the official delegate of the American Concrete Institute of which he is Vice President.

During his three months trip, Professor Abrams will visit research laboratories of cement and other industries as a part of a comprehensive study of this phase of manufacturing practice abroad. This study will include plants in Belgium, France, Switzerland and England. Professor Abrams' visit should not alone be of great value to the International Cement Corporation and the industry as a whole but it no doubt will foster more friendly relations with European manufacturers.

New Asbestos Plant

A plant for the preparation of asbestos for the market is being erected by the National Asbestos Company at Minneapolis, North Carolina. There are a number of deposits of this mineral in the state of North Carolina and probably the largest and most promising ones are within three miles of the new plant. The plant will have a daily capacity of thirty tons.

General Wheelbarow Co. Succeeds Akron Barrow

The Akron Barrow Company has announced that effective September first the name of the company will be changed to the General Wheelbarrow Company. In explanation of the change of name the company declares that the general expansion of their line and the change in the location of their plant from Akron to Cleveland has made the move advisable. No changes in the financial structure of the company or in its personnel are contemplated.

New Incorporations

The Rock Asphalt Company has been incorporated for $750,000 at Bowling Green, Pa., to deal in rock asphalt and cement.

Olympian Stone Co., Seattle, Wash. $10,000. Lee Swartz, S. C. Kingborn. (Corr., Williams & Davis, 502 Commerce Bldg., Everett, Wash.)

Rockfield Lime & Stone Co., Rockfield, Wis. Peter J. Hayes. 250 shares pfd. at $100; 250 shares n.p.v.

Moraine Asphalt Sand Co., Dayton, Ohio. $100,000. Charles M. Peffler, Clifton Hollihan, E. B. Raymond.

Independent Asphalt & Construction Co., Inc., St. Louis, Mo. Mr. John A. Butler, 1233 Daytonia Terrace, Joseph S. Casey, M. M. Butler, 4247 DeFonty St.

Jaeger & Minchillo (stone contractors), Bradley Hills, Montgomery County, Md. Fourteen acres of the Hamilton tract at $1,000 an acre.

Mystic Stone Quarries Co.. Louisville, Ky. $30,000. Clark S. Lampton, 1350 S. Sixth St.; Charles A. Staebler, St. Matthews St.; W. L. Staebler.

Huber Rock Corp., Tallahassee, Fla. 1000 shares n.p.v. Morris Huber, Frank L. Webb, Helen Huber.

Arkansas Portland Cement Co., White Cliffs, Ark.; $2,000,000. Charles Boettcher, Pres.; C. D. Nichols, Vice-Pres.; Philip Thompson, Sec'y., and M. O. Matthews, Treas.

The Hoadley Cut Stone Co., Inc., 1385 N. Norton Ave., Columbus, Ohio.

Ideal Cement Co., White Cliffs, Ark., $2,000,000 plant under construction and will be completed and in operation by May 1, 1928.

The Reader Gravel Company has been incorporated at Lewisville, Arkansas, in the amount of $50,000.

The Georgia Marble Company of Jasper, Ga., is reported to be opening up a vein of green marble in Cherokee County.

DISTRIBUTION OF CEMENT

Portland cement shipped from mills into States in May and June, 1926 and 1927, in barrels*

Shipped to	May 1926	May 1927	June 1926	June 1927
Alabama	184,774	164,359	215,892	155,252
Alaska	2,296	2,514	1,130	1,823
Arizona	37,717	46,724	46,262	45,172
Arkansas	64,713	77,207	66,835	77,555
California	1,165,540	1,281,461	1,187,724	1,153,990
Colorado	119,761	109,671	124,451	95,029
Connecticut	209,515	193,315	206,301	255,970
Delaware	38,972	35,564	45,642	32,807
District of Columbia	85,961	79,566	86,218	87,224
Florida	386,712	234,914	297,204	199,406
Georgia	186,398	209,126	174,488	196,027
Hawaii	13,705	25,631	14,360	31,227
Idaho	58,044	26,767	54,424	29,085
Illinois	1,671,317	1,402,964	1,854,806	1,921,502
Indiana	570,942	561,019	†673,087	739,188
Iowa	317,323	357,184	329,422	553,469
Kansas	259,208	294,596	247,335	243,653
Kentucky	188,486	188,319	†181,121	201,477
Louisiana	96,519	116,352	106,338	119,191
Maine	51,441	49,870	66,264	67,820
Maryland	279,126	224,398	244,763	245,061
Massachusetts	362,878	289,218	338,079	320,541
Michigan	1,182,060	1,258,924	†1,439,270	1,504,877
Minnesota	496,800	387,814	526,695	485,312
Mississippi	73,146	74,061	73,345	76,227
Missouri	696,773	409,889	631,184	438,193
Montana	23,832	24,561	23,114	33,243
Nebraska	190,275	155,964	187,780	145,564
Nevada	8,165	7,495	9,895	12,853
New Hampshire	46,559	38,333	48,285	47,672
New Jersey	770,730	894,457	773,450	944,454
New Mexico	12,004	31,149	16,222	21,991
New York	2,223,644	2,188,026	2,475,868	2,839,613
North Carolina	424,474	367,215	420,248	325,413
North Dakota	58,351	40,034	75,470	74,012
Ohio	1,200,619	†966,808	†1,319,226	1,309,273
Oklahoma	229,209	†309,509	219,946	266,615
Oregon	127,318	152,050	150,962	172,173
Pennsylvania	1,614,063	1,331,265	1,697,387	1,719,593
Porto Rico	0	2,250	0	1,750
Rhode Island	96,407	77,876	80,912	68,486
South Carolina	58,544	87,442	47,279	64,616
South Dakota	61,899	38,442	53,091	54,405
Tennessee	201,130	217,416	206,917	219,588
Texas	431,778	545,848	447,231	419,994
Utah	38,301	32,759	66,883	40,344
Vermont	28,202	29,715	32,291	42,594
Virginia	196,368	168,463	211,665	204,817
Washington	212,259	223,574	260,756	295,426
West Virginia	217,546	141,521	†208,797	170,166
Wisconsin	537,441	568,828	691,934	869,960
Wyoming	17,558	17,531	20,331	25,173
Unspecified	70,063	40,626	†80,565	16,544
	17,896,866	16,800,584	†19,059,145	19,683,410
Foreign Countries	76,134	58,416	74,855	47,590
Total shipped from cement plants	17,973,000	16,859,000	19,134,000	†19,731,000

*Includes estimated distribution of shipments from three plants in May and June, 1927; from four plants in June, 1926; and from five plants in May, 1926.
†Revised.

Production, shipments and stocks of finished Portland cement, by districts, in July, 1926 and 1927, and stocks in June, 1927

Commercial District	July Production 1926	July Production 1927	July Shipments 1926	July Shipments 1927	Stocks at end of July 1926	Stocks at end of July 1927	Stocks at end of June *1927
Eastern Pa., N. J., & Md.	3,935,000	4,080,000	4,215,000	4,237,000	3,687,000	4,236,000	4,394,000
New York	911,000	1,258,000	1,146,000	1,263,000	992,000	1,482,000	1,487,000
Ohio, Western Pa. & W. Va.	1,851,000	1,909,000	2,053,000	2,056,000	2,109,000	2,806,000	2,953,000
Michigan	1,506,000	1,460,000	1,681,000	1,674,000	1,558,000	1,758,000	1,971,000
Wis., Ill., Ind., & Ky.	2,438,000	2,360,000	3,017,000	2,935,000	2,400,000	1,857,000	2,432,000
Va., Tenn. Ala., Ga. & La.†	1,445,000	1,504,000	1,419,000	1,465,000	1,150,000	1,245,000	1,206,000
Eastern Mo., Ia., Minn. & S. D.	1,576,000	1,509,000	1,756,000	1,931,000	2,237,000	2,419,000	2,841,000
Western Mo., Neb., Kan. & Okla.	1,067,000	964,000	1,160,000	1,035,000	1,362,000	1,671,000	1,743,000
Texas	459,000	458,000	464,000	472,000	472,000	316,000	330,000
Col., Mont., Utah	312,000	239,000	269,000	254,000	413,000	526,000	541,000
California	1,302,000	1,264,000	1,276,000	1,241,000	508,000	624,000	601,000
Oregon and Washington	332,000	393,000	356,000	421,000	413,000	397,000	424,000
	17,134,000	17,398,000	18,812,000	18,984,000	17,301,000	19,337,000	20,923,000

*Revised. †Began producing June 1927, and shipping July, 1927.

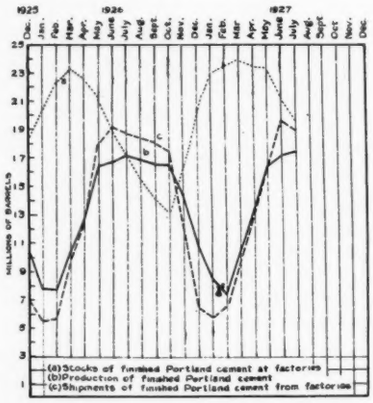
Domestic hydraulic cement shipped to Alaska, Hawaii and Porto Rico, in June, 1927*

	Barrels	Value
Alaska	3,364	$10,360
Hawaii	18,178	42,327
Porto Rico	6,761	16,571
	28,303	69,258

*Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

JULY CEMENT STATISTICS

Production of portland cement in July has never been surpassed in any month, according to the Bureau of Mines, Department of Commerce. July shipments of portland cement are well over those of July, 1926, and have been exceeded only by those of June, 1926 and 1927. Stocks of portland cement continue to decline but are nearly 12 per cent higher than on July 31, 1926.



The output of three more new plants, located, resepectively, two in New York and one in Iowa, is included in these statistics, which are prepared by the Division of Mineral Statistics of the Bureau of Mines and are compiled from reports for July, 1927, received direct from all manufacturing plants except two, for which estimates are necessary on account of lack of returns.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20 cents each. State number of patent and name of inventor when ordering.

1,636,138. Ball or tube mill. Wilhelm Koppen, Beckum, and Christian Pfeiffer, Neubeckum, Germany.

1,636,168. Sand-cutting machine. Oscar A. Butterfield, Battle Creek, Mich.

1,636,220. Selective dumping device for bucket-conveyors. William R. Eddington, Morgan, Utah.

1,636,367. Process of coating concrete pipes and hollow bodies with bituminous compositions. Robert Illemann, Glasgow, Scotland.

1,636,384. Sand mulling and aerating machine. William H. Nicholls, Brooklyn, N. Y.

1,636,585. Ball mill. William M. Barker, Canton, Ohio.

1,636,693. Pulverizing-machine. Paul A. Hirsch, New York, N. Y., assignor to Furnace Engineering Co., same place.

1,636,926. Drive for transit concrete-mixers. Charles L. Reynolds, Seattle, Wash.

1,637,073. Scraper. Alfred B. Esseltine, Chicago, Ill., assignor to Goodman Mfg. Co., same place.

1,637,215. Concrete slab. Frederick D. Coppock, Greenville, Ohio.

1,637,457. Power boom-swinging mechanism. Richard W. Runge, Oshkosh, Wis., assignor to Leach Co., same place.

1,637,625. Sand cleaning and classifying device. Edmund Shaw, Chicago, Ill.

1,637,689. Steam shovel. Joseph P. Endersby, Vancouver, British Columbia.

1,637,742. Reinforced-concrete construction. Walter S. Edge and Russell C. Olmstead, New York, N. Y.

1,637,783. Mining and loading machine. Edmund C. Morgan, New York, N. Y.

1,637,986. Screen-grate and ball-mills. William Currie, Carteret, N. J., assignor to Chrome Steel Works, same place.

1,638,080. Concrete building construction. Albert F. Bemis, Newton, and Horatio W. Brown, Concord, Mass., assignors to Bemis Industries, Inc., Boston, Mass.

1,638,099. Endless-chain excavator-bucket with digging-teeth. Claude Rorabeck, Chicago Heights, Ill., assignor to American Manganese Steel Co., Chicago, Ill.

1,638,361. Mining-machine. Nicola Pedulla, Meyersdale, Pa.

1,638,507. Mining and loading machine. Edward O'Toole, Gary, W. Va.

Largest Stone Contract

President A. E. Dickinson of the Indiana Limestone Company has announced the closing of the largest single stone contract ever let. It will be used for the construction of the largest office building in the world, the New York Life Insurance Company Building at New York. The amount of stone required is 450,000 cubic feet or a thousand car loads, making a train six miles long.

The Rockland and Rockport Lime Corporation of Rockland, Maine, has taken over the Bryant Company, manufacturers of high calcium lime of Rockport, Maine.

Production, shipments and stocks of finished Portland cement, by months, in 1926 and 1927

	Production		Shipments		Stocks at end of month	
	1926	1927	1926	1927	1926	1927
January	7,887,000	8,258,000	5,674,000	5,968,000	20,582,000	22,914,000
February	7,731,000	7,377,000	5,820,000	6,731,000	22,385,000	23,560,000
March	10,390,000	11,452,000	9,539,000	11,083,000	23,236,000	23,922,000
1st quarter	26,008,000	27,087,000	21,033,000	23,782,000	.....	.....
April	12,440,000	14,048,000	12,965,000	14,350,000	22,710,000	23,654,000
May	16,510,000	16,674,000	17,973,000	16,859,000	21,255,000	23,482,000
June	16,866,000	*17,167,000	19,134,000	*19,731,000	19,000,000	*20,923,000
2nd quarter	45,816,000	47,889,000	50,072,000	50,940,000	.....	.....
July	17,134,000	17,398,000	18,812,000	18,984,000	17,301,000	19,337,000
August	16,995,000	.....	18,583,000	.....	15,718,000	.....
September	16,571,000	.....	18,087,000	.....	14,188,000	.....
3rd quarter	50,700,000	.....	55,482,000	.....	.....	.....
October	16,596,000	.....	17,486,000	.....	13,334,000	.....
November	14,193,000	.....	11,276,000	.....	16,243,000	.....
December	10,744,000	.....	6,432,000	.....	20,616,000	.....
4th quarter	41,533,000	.....	35,194,000	.....	.....	.....
	164,057,000	.....	161,781,000	.....	.....	.....

*Revised.

EXPORTS AND IMPORTS*

Exports of hydraulic cement by countries, in June, 1927

	Barrels	Value
Canada	1,819	$ 10,169
Central America	13,751	42,178
Cuba	11,245	30,324
Other West Indies and Bermuda	4,333	11,884
Mexico	9,239	27,538
South America	23,508	84,016
Other countries	5,310	31,172
	69,205	$237,281

Imports of hydraulic cement by countries, and by districts, in June, 1927

Imported from	District into which imported	Barrels	Value
Belgium	Florida	19,172	$ 27,993
	Massachusetts	35,502	59,133
	New Orleans	3	6
	New York	3,000	3,973
	Philadelphia	32,380	46,775
	Porto Rico	3,000	6,468
	Rhode Island	14,703	19,498
	Total	107,760	$163,846
Canada	Saint Lawrence	2,750	10,165
Czechoslovakia	Porto Rico	1,000	1,483
Denmark	Porto Rico	14,000	21,348
Germany	Los Angeles	200	440
	New Orleans	410	419
	Total	610	$ 859
Norway	Los Angeles	500	572
	New York	1,748	2,307
	Total	2,248	$ 2,879
United Kingdom	Philadelphia	743	1,102
	Grand Total	129,111	$201,682

Exports and imports of hydraulic cement, by months, in 1926 and 1927

	Exports				Imports			
	1926		1927		1926		1927	
Month	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	72,939	$ 216,431	75,346	$254,072	360,580	$ 576,717	193,175	$269,661
February	73,975	220,706	71,404	233,985	314,118	527,948	130,421	200,680
March	69,080	205,647	67,956	240,165	493,241	812,968	181,145	261,519
April	96,296	284,772	72,383	243,832	257,302	398,114	191,868	313,262
May	78,601	224,365	59,332	205,574	223,130	337,031	178,929	263,618
June	80,684	248,814	69,205	237,281	335,570	495,744	129,111	201,681
July	130,822	370,220	.....	.....	250,862	395,981	.....	.....
August	64,946	216,489	.....	.....	350,638	560,532	.....	.....
September	70,920	239,174	.....	.....	104,129	308,224	.....	.....
October	69,389	225,874	.....	.....	263,403	386,335	.....	.....
November	76,598	238,103	.....	.....	55,233	82,949	.....	.....
December	89,976	305,238	.....	.....	151,850	246,293	.....	.....
	974,226	$2,995,833	.....	.....	3,250,056	$5,128,836	.....	.....

*Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

Production of Sheet Mica Increased in 1926

The total quantity of uncut mica sold by producers in the United States in 1926, as reported by the United States Bureau of Mines, Department of Commerce, was 8,129 short tons, valued at $536,827. Of this quantity 1,086 tons (2,172,159 pounds), valued at $400,184 was sheet mica; the rest was scrap mica. The production was made by nine States: North Carolina, New Hampshire, New Mexico, South Dakota, Virginia, Georgia, Colorado, South Carolina, and Connecticut, named in order of total quantity from greatest to least.

DOMESTIC UNCUT MICA SOLD BY PRODUCERS IN THE UNITED STATES IN 1925 AND 1926

	Sheet mica		Scrap mica	
	Pounds	Value	Short tons	Value
North Carolina:				
1925	592,478	$105,376	5,095	$74,818
1926	700,313	150,362	2,880	54,048
New Hampshire:				
1925	1,120,857	198,858	1,953	47,525
1926	1,371,890	235,890	1,738	38,213
New Mexico:				
1925	34,486	7,531	920	14,580
1926	46,104	5,824	988	16,683
Other States[1]:				
1925	46,044	10,197	1,727	36,614
1926	53,852	8,108	1,437	27,699

1. Alabama, Colorado, Connecticut, Georgia, Maine, Nevada, South Carolina, South Dakota and Virginia.

The total sales of uncut sheet mica in 1926 showed an increase of 21 per cent in quantity and 24 per cent in value, as compared with 1925. The total scrap mica sold showed a decrease of 27 per cent in quantity and 21 per cent in value, as compared with 1925. The sales of uncut sheet mica in North Carolina showed an increase of 18 per cent in quantity and 43 per cent in value. New Hampshire showed corresponding increases of 22 per cent in quantity and 19 per cent in value.

The average value per pound of all sheet mica sold in the United States in 1926 was about 18 cents, the same as in 1925, and the average value of scrap mica a short ton was about $19 in 1926, as compared with $18 a ton in 1925. The imports of mica for consumption were 6,318,096 pounds, valued at $2,450,834. Corresponding figures for 1925 were 4,901,308 pounds, valued at $1,798,827.

National Lime Moves Office

The general offices of the National Lime and Stone Company and those of the National Quarries Company, which has lost its identity because of becoming a part of the National Lime and Stone Company, moved from Carey, Ohio, to the Buckeye Commercial Bank Building, Findlay, Ohio.

New Silica Reduction Plant in Operation

The reduction plant of the Mt. Shasta Silica Company of Redding, California, near Pitthree on the Pit River is now completed and in operation, according to advices received from Chas. O. Willis, superintendent of the company.

The plant will give employment to about thirty-five men and will have a capacity of 200 tons per day.

The mill is a building fifty-two feet by fifty-seven feet and is fifty-seven feet high. With equipment the plant will cost at least fifty-seven thousand dollars and possibly more.

The works stand 1700 feet from the Pitthree power house and 1200 feet from the Pacific Gas and Electric Company's Railroad. A spur track will be built from the railroad.

The mill is arranged to clarify and reduce the diatomaceous earths to fine silica. The product from the mines will be run through rollers and then elevated by the conveyor belts to the top of the building, where it will pass through air blasts. The screens vary from twelve to three hundred meshes to the inch.

The company has over forty claims of 160 acres each and the diatomaceous earth is so prolific it can be mined with a shovel.

Shipments to the various manufacturing centers were begun as soon as the plant was put into operation, and the plant has already become an important industry in Shasta County.

The Mt. Shasta Silica Company has its principal office in Weed, most of the stockholders being residents of Weed and Yreka, California.

Forty-five of the claims are named Insulator with distinguishing numbers attached. Ten claims are named Shasta Diatomite and three are Second Thoughts. There are eight locators for each claim, nearly all the claims being of 160 acres each, and as 20 acres can be claimed for each placer, it is safe to say that the area located by the Mt. Shasta Silica Company is over 10,000 acres in extent.

J. M. White is president of the company and M. H. Niemeyer of Weed is secretary of the company.

New Arkansas Cement Plant Appears to Be Reality

With the recent purchase of the controlling interest in the Graysonia, Nashville and Ashdown Railroad for the purported sum of $500,000, the plans of the Oklahoma Portland Cement Company for the erection of a $3,500,000 cement plant at White Cliffs, near Ashdown, Arkansas, are believed to be near consummation. The cement plant, it is reported, will have a capacity of 1,500 barrels per day and will be served by the purchased railroad, which runs directly through the property.

Missouri Portland Active in New Cement Project

It is reported that the expenditure of approximately $1,500,000 in the construction of a cement manufacturing plant near Batesville, Arkansas, will be undertaken in the near future by the Missouri Portland Cement Company. The capacity of the plant will be 500 barrels per day and the materials used in the manufacturing process will be limestone and shale which are found in huge quantities in this vicinity, as well as gypsum and bauxite.

New Dolomite Plant Going

The new 200-ton plant of the Dolomite Products Company, Maple Grove, Ohio, was put into operation for the first time August 16. The new plant supplants the one which has been in operation at the quarry for a number of years and by doubling the output makes the Dolomite one of the largest in its part of the state. Company officials, including H. P. Eells, president, witnessed the opening ceremonies.

Survey Indiana Limestone

A survey of Indiana's Oolitic limestone districts is being carried on by geological field forces of the state conservation department with a view of determining additional fields and the character of the outcroppings.

A map is being prepared which will show the outcrop area, the location of quarries, mills, railroads and other geographic and physiographic features of the region. The survey further is giving conservation for a more extended use of the waste stone.

NEWS OF EQUIPMENT MANUFACTURERS

Charles A. Perryman Joins American Cable

According to recent announcement, Mr. Charles A. Perryman, former sales manager of the wire rope department of the Wickwire Spencer Steel Company, Inc., is now associated with the American Cable Company, makers of the preformed "Tru-Lay" type of wire rope, in the capacity of assistant sales manager. Mr. Perryman will make his headquarters at 105 Hudson street, New York City.

Westinghouse Awards Scholarship

Two New York and two Pittsburgh youths were the winners in the 1927 contests for war memorial scholarships offered each year by the Westinghouse Electric and Manufacturing Company in memory of the Westinghouse employees who lost their lives in the World War. The winners were: H. L. Bunker, Jr., son of H. L. Bunker, rate setter, East Pittsburgh works, who will attend Carnegie Institute of Technology; P. J. Glaister, tester, East Pittsburgh works, who will attend Cornell University; M. T. Ayres, son of M. C. Ayres, foreman of dial markers, Neward works, who will attend the Massachusetts Institute of Technology, and A. L. Kine, son of R. R. Kine, salesman, New York Office, who will attend Princeton University.

The scholarships carry a fund of $500 a year for a period of four years. Over 52 were entered in the contest. Vice-presidents L. A. Osborne and Walter Cary and Acting Vice-President T. P. Gaylord were the deciding committee. Thirty-two students have received scholarships since the beginning. Eighteen of these have graduated, and eleven are still in school.

To Develop Dry Quenching Coke System

Dry Quenching Equipment Corporation is the name of a new subsidiary of the International Combustion Engineering Corporation which has acquired from the Swiss firm of Sulzer Bros. the Sulzer System for dry quenching coke, utilizing the heat energy in the coke which is at present lost by wet quenching.

The system has been widely used in Europe. The first unit in this country was installed by Sulzer Bros. for the Rochester Gas and Electric Corporation.

H. D. Savage will be president of the new subsidiary and the other directors will include George E. Learned, president of the International Combustion Engineering Corporation, chairman; C. G. G. Hunter; Geo. E. Hansel; Hans Sulzer and F. Oederlin of Winterthur, Switzerland; and E. N. Goodwin of New York.

Walter Sennhauser, at present connected with the Sulzer Bros. in Winterthur will come to this country as chief engineer.

Republic Motor Truck Buys Tractor Corporation

The Republic Motor Truck Company has purchased the entire capital stock of the Linn Manufacturing Corporation, tractor manufacturers, and is now the sole owner of that company, including its plant, equipment, good will and exclusive selling rights.

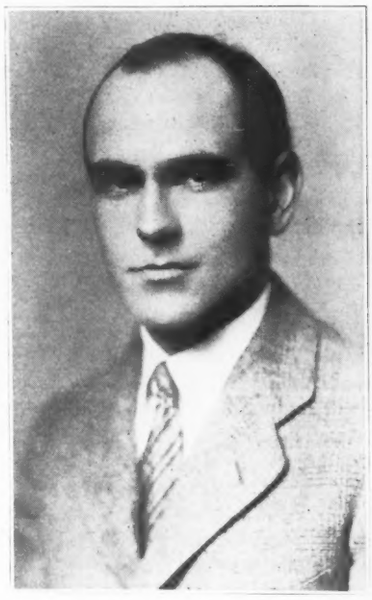
The operation of the newly purchased company will be continued as a division of the Republic Motor Truck Company and the personnel of the company will remain the same.

The Linn tractor is a heavy duty machine equipped with either a 75 or 100 h.p. engine. It resembles a heavy motor truck, except the revolving tracks take the place of rear wheels. The motor and front wheels are similar to those of any heavy duty truck. It does not replace the truck but it will and does operate in places where it is imposible for the truck to go.

G. H. Williams Changes

H. B. Ackland has been appointed manager of the New York territory of the G. H. Williams Company, bucket manufacturers. His office will be at 30 Church street, New York City. He previously represented the company in New England as well as in the New York metropolitan district. He has had a long and varied experience in supervising the types of equipment on which digging buckets are used. He was formerly associated with Dwight P. Robinson, Inc. Mr. Ackland succeeds E. L. Sparks, whose personal business made it necessary to move to the Pacific coast.

C. F. Weiblen has been appointed direct factory representative in the Ohio district, with headquarters in Cleveland. Mr. Weiblen has also had a very wide experience in all classes of bucket work, rounded out by experience at the factory, which equips him unusually well to work out excavating and rehandling problems.



George Kirtley

George Kirtley Promoted

George Kirtley, who, for the past five years, has been connected with the main sales office of H. K. Porter Company in Pittsburgh, has been made western sales manager of the company. He will be located in the Monadnock building, Chicago.

Micarta Gears and Pinions

The latest authentic data and technical information on the manufacture, design and form of construction of Micarta gears and pinions is given in circular 1579-E, just issued by the Westinghouse Electric and Manufacturing Company. Micarta is a self-supporting laminated product of specially treated woven fabric which has found a wide application in the non-metallic gear field because of the special characteristics which make it adaptable to use as gears and pinions. Micarta gears, because of their silent, efficient and economical operation, are used by many manufacturers in place of untreated steel, cast-iron and bronze.

In addition to the general and technical information, a new formula and tables, based on the recommended practice of the American Gear Manufacturers' Association, are features of this gear booklet. The new gear formula, adopted at the May, 1927, meeting of the A. G. M. A., gives Micarta gears much higher horsepower ratings at higher speeds than heretofore. These ratings are of special significance to those who are interested in these problems.

New Williams Crusher For Muddy Rock

A new type of hammermill for wet, muddy rock is a new product of the Williams Patent Crusher and Pulverizer Company. The machine is equipped with a pusher type feeder and vibrating grates and will crush to ¾ inch and under, which is not possible with the tractor type feed due to the clearance required between the linked breaker plate and the first grate bar. The actual crushing is accomplished by the hinged hammer principle.

As the wet material enters the crusher it is pushed into the path of the hammers by two reciprocating, flat piston-like rams which scrape the breaker-plate clean and force the material into the crusher. These rams are actuated by a heavy crank shaft driven from the main crusher shaft.

This hammermill is an improvement in the handling of wet material in that it provides an oscillating or vibrating arrangement for the grates of the machine. The arrangement operates on a crank shaft, the eccentric rolling the grate bars back and forth like the ash-dumping grates of a furnace fire box. The grate opening always remains the same and there is no possibility of oversized material getting into the finished product.

An adjustment is also provided so that the grate bars can be raised as they wear, toward the hammers and the fast revolving hammers aid the vibrating action in keeping the grates clean and free of material.

All non-clog mechanism is driven from the main crusher shaft and no auxiliary drive is required. Only two gears are used and these are so placed and protected as to positively prevent entry of dirt and grit. This new pusher type feeder and vibrating grates are available in all the sizes of hammermill crushers which the company manufactures.

New Portable Testing Units

A new type of portable testing instrument, designated as type AS-2 has been announced by the General Electric Company. These instruments, compact in construction, were designed for general testing and inspection work in industrial plants and power stations. They are repulsion type instruments and while primarily intended for use on alternating current circuits they can also be used to advantage on direct current.

Both ammeters and voltmeters are supplied and both are double rated. Ammeters are supplied self-contained in ratings not exceeding 20 amperes. For higher ratings, five ampere instruments should be used with current transformers. Voltmeters are self-contained in ratings not exceeding 300 volts. For higher voltage, external portable multipliers are supplied.

The scale length is approximately three inches and is quite open at the central and upper portions. The case and cover are of molded bakelite made to resemble Morocco leather.

New Speed Changer Described

The Stephens-Adamson Manufacturing Company have just issued a 24-page bulletin, number 156, of their "Labor Saver" series. This issue features and describes in detail a new variable speed speed-changer.

New P & H Branch

The Harnischfeger Corporation will open a new branch office at 524 Buder building, St. Louis, Missouri. Mr. L. J. DeHoney, sales engineer, will direct the work in the St. Louis territory. Mr. DeHoney has had considerable experience in selling power shovels, draglines and clamshell cranes.

Wm. E. Brown Promoted

William E. Brown, manager of the central station department of the New York district of the General Electric Company has been appointed New York district sales manager of the company. His headquarters will be at 120 Broadway, New York.

New Zelnicker Bulletin

The Walter A. Zelnicker Supply Company has recently issued a bulletin describing offerings in new and used equipment. The bulletin lists air compressors, boilers, tanks, motors, locomotives, cranes, buckets, steam power shovels, drag lines, ditchers, car rails and other kindred equipment.

Dorr Company Advances

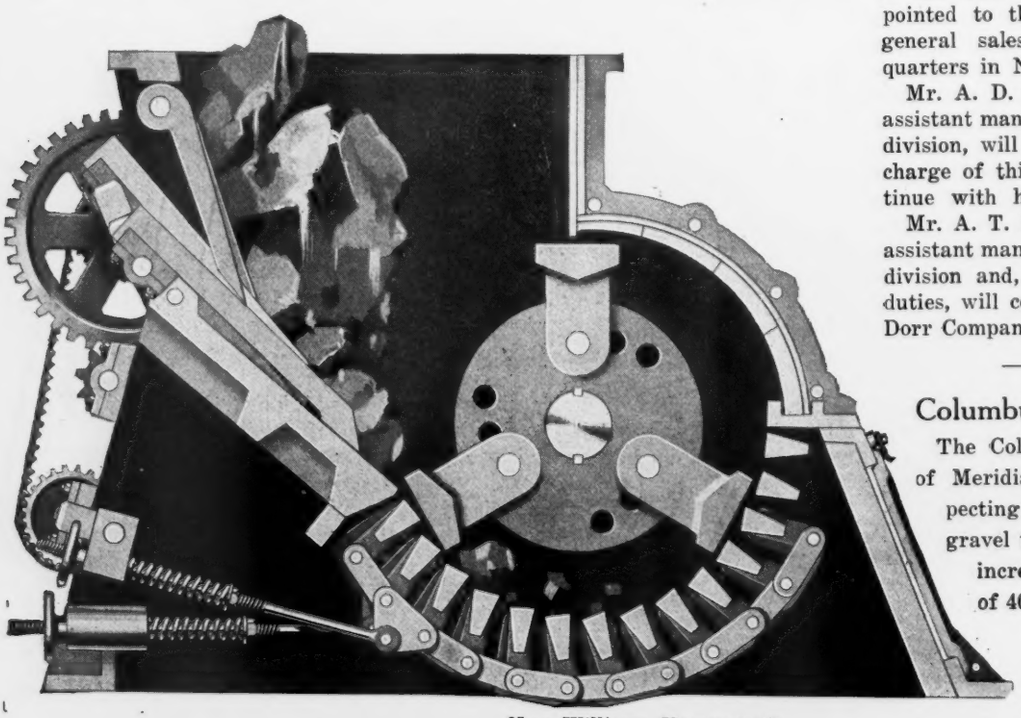
Mr. E. R. Ramsey, heretofore in charge of the metallurgical division of the Dorr Company, has been appointed to the position of assistant general sales manager with headquarters in New York.

Mr. A. D. Marriott, who has been assistant manager of the metallurgical division, will succeed Mr. Ramsey in charge of this division and will continue with headquarters in Denver.

Mr. A. T. Hastings has been made assistant manager of the metallurgical division and, in addition to his new duties, will continue in charge of the Dorr Company's office in Los Angeles.

Columbus Gravel Expands

The Columbus Gravel Company of Meridian, Mississippi, are expecting to develop an additional gravel tract of 570 acres and to increase their present output of 40 cars per day to 125 cars per day, according to C. F. Harris, general manager.



New Williams Hammermill

A New Revolving Shovel

The Marion Steam Shovel Company has recently developed and placed on the market the Type 490 full revolving electric shovel. This machine is rated 2¼ cubic yards and is a heavy duty loading shovel, equipped with Ward-Leonard control, especially adapted to heavy quarry service, ore loading, sand and gravel plants. The machine is mounted on two-belt rigid crawling traction trucks, making the machine extremely mobile to move quickly into or away from the bank, into and around small narrow places and over the roughest surface. The control for all motions is located at the operator's position, including steering, which is controlled by rotating the cab.

The lower frame is a one-piece alloy steel casting, designed to withstand the severe service of hard digging and steady operation. The main body of the upper frame is a heat treated alloy steel casting, to which suitable structural extensions have been added to complete the upper deck for mounting the main machinery. All parts entering into the construction of the upper frame have been suitably reinforced.

The Ward-Leonard control, which has been pioneered by Marion on the larger units, is used on the Type 490, thus giving the machine a flexibility never before equalled on a machine of this size. The use of Ward-Leonard control makes each motion absolutely independent of every other motion and gives not only the maximum protection to the machine, but inherently adapts itself to all conditions by giving high speeds for the light loads and low speeds for the heavy loads. In this respect the machine has the desirable characteristics of steam drive, which, from the standpoint of operating characteristics is known to be the ideal type of power for shovel use.

The front end equipment consists of a massive all-steel boom, a combination wood and steel dipper handle of the "inside" type and a dipper of special design to meet the conditions encountered in rock work. It is equipped with three-part hitch which, combined with large drum and sheave diameters, gives unusually long life to the hoisting cable. The front end construction of the Type 490 follows the construction used so successfully for many years on the railroad type of shovel.

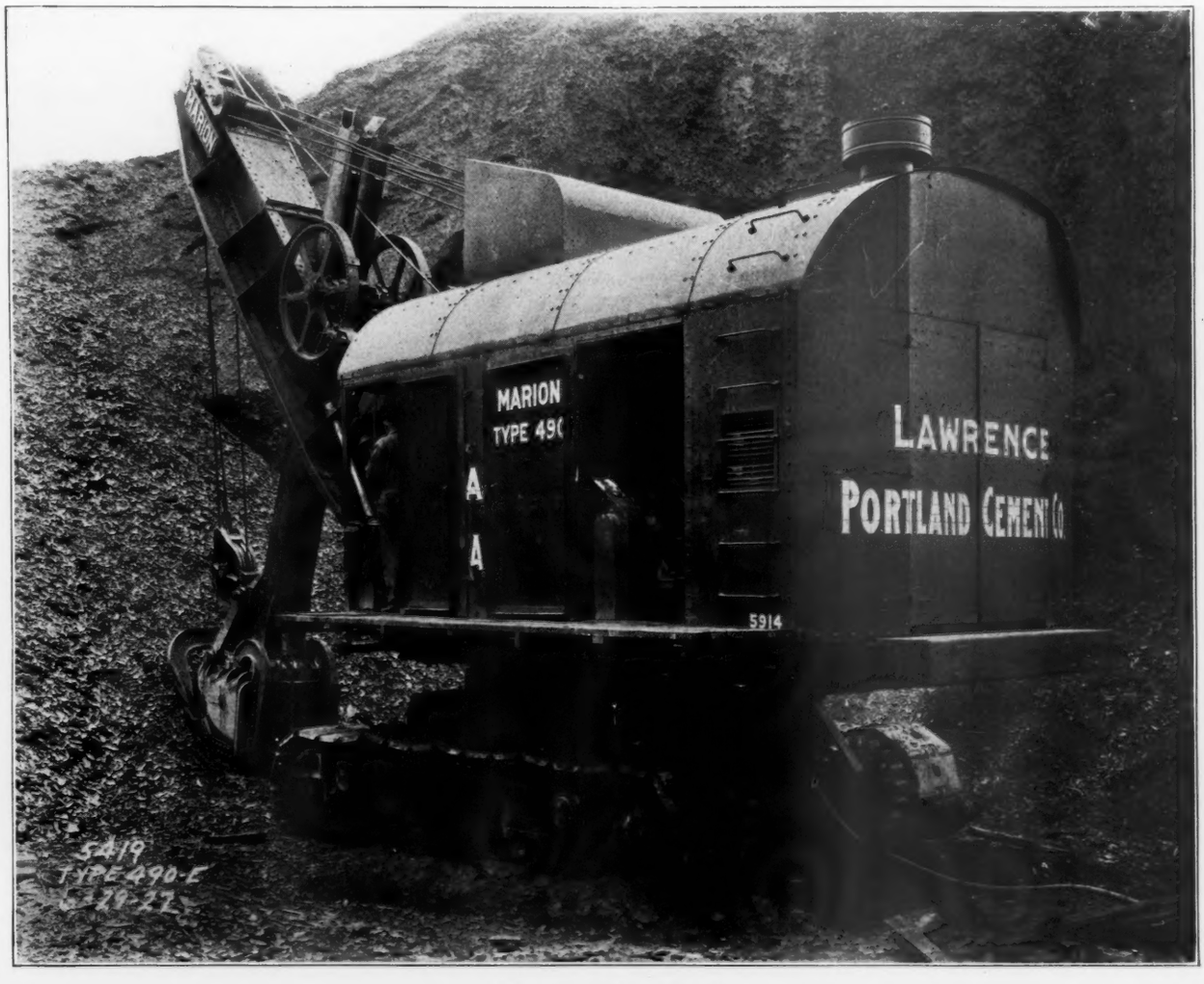
The Type 490 is equipped with a strong all-steel house, suitably ventilated and arranged to protect the machinery from the elements and from the debris caused by blasting. On account of its tremendous bail pull of 46,000 pounds, its sturdy construction, extreme mobility and low price, the machine is excellently adapted to the quarrying and heavy contracting field.

The illustration below shows this new type Marion revolving shovel in action and gives an idea of the notable construction features outlined above.

Equipment Sales Move

The Equipment Sales Company has changed the location of their general offices from Nashville, Tennessee, to Richmond Trust Building, Richmond, Virginia.

The company believes it will be in a better position to handle inquiries at the new address than in the past.



New Revolving Shovel

New Half Yard Excavator

A new ½ yard excavator has been added to the list of machines manufactured by the Harnischfeger Corporation. The machine has been tested in actual service during the past two years.

It has fast line speeds, and revolves at a rate of 5½ times per minute. The machine is equipped with a 50 h.p. motor, and with standard 18 foot boom, 13 foot 3 inch dipper sticks, and a heavy plate steel dipper; it weights 40,500 pounds. The rear end swing of this full revolving ½ yard machine is only 7 feet 1½ inches. The machine is convertible for use as a shovel, dragline, clamshell, pile driver, etc. It handles a ½ cubic yard clamshell bucket on a 35 foot boom and has a lifting capacity of 11,400 pounds at 12 foot radius.

The same type of power clutch controls, steering device, and crowding motion, used on the company's ¾, 1 and 1¼ yard machines for many years, are characteristic features of the new excavator.

New Half Yard Excavator on the Job

A New Design of Takeup

The Link-Belt Company has designed an improved protected screw type takeup for heavy work and long movement, to be known as style DS. The diameters of screws, lengths of bearings, strengths of frames, etc., are all correctly proportioned for the size of shaft, and length of movement, insuring maximum strength with minimum weight.

The frame is of welded structural steel with channel base welded to ends formed of steel plates, bent and welded into strong box members, in which the adjusting screw is mounted. The steel angle bolted on top of ends protects the screw from dirt or the weather, in addition to tying the ends together, strengthening the frame and preventing upward movement of bearing. The protected screw remains fixed in position, and the nut for adjusting the movement of bearing travels on the screw. The movement-adjusting screw does not project beyond the ends of the frame, or require additional space and special framing. The rugged cast iron bearing is lined with high grade of babbitt, tapped for grease cup pressure fitting, and is correctly proportional in length for each diameter of shaft.

Largest Dorr Thickener

An example of engineering progress and success in building large equipment to meet the increasing tonnage requirements of modern industry has come to light in the purchase recently of the largest Dorr Thickener ever built. This Dorr Thickener, which is of the traction type, is 325 feet in diameter, and some conception of its size may be obtained when it is realized that it will provide almost two acres of settling area.

The unit will be used at the copper flotation plant of the Miami Copper Company, Miami, Arizona, for dewatering 1,600 tons of mill tailings and recovering for reuse in the plant about 11,500,000 gallons of water per day. This Door Thickener has more than twice the capacity of any thickener built before. With the exception of certain improvements, the design closely follows that of the 200 foot units at Inspiration Copper Company which have been operating several years in this district.

A New Morse Chain

The Morse Chain Company, manufacturers of rocker-joint chain and silent chain drives, has announced an improved chain. The improvements are principally due to changes in the design of the rocker joint. The new design known as 55 type chain, will run on all sprockets, the new link being the same length and height as the old.

The new joint operates on the same principle as the original Morse rocker joint. The seat pin has been enlarged to give greater bearing surface and also to make it a stronger transverse member to hold the chain together. The rocker pin has been changed in contour, thereby giving a better surface of contact with the links.

The combined joint members give a more nearly round hole with reduced clearance, holding the links more securely on the pins. A better balanced joint, heavier than the old, produces a smoother running chain. It is a more rugged chain as the joint pins are about 8 per cent heavier and the complete chain weighs twice the pitch per inch foot. The breaking strength is increased about 50 per cent.

The improved, better balanced joint, with larger bearing surfaces and pins more securely held in the links, permits increased tension without shortening the life of the drive. The company has recently installed modern automatic electric furnaces to insure uniform heat treating of the parts entering into the chain.

Novel Advertising Booklet Issued by Fairfield

The Fairfield Engineering Company has recently issued a small brochure which is both timely and well prepared. On the outside of the brochure appear several views of Niagara Falls, and the injunction "For your vacation." As the mailing piece is opened up one reads "For your vacation buy a Fairfield" carrying the natural inference that the purchase of efficient equipment will enable one to take a vacation. The brochure is profusely illustrated with views of the company's product in actual application and also contains a return inquiry blank. As a novel method of advertising this little mailing piece deserves a high rating.

Diesel Engine Developments Described

The fascinating history of the development of the Diesel engine has another chapter added in the recent publication by the Worthington Pump and Machinery Corporation of their Bulletin S-173, describing the Worthington double-acting two-cycle Diesel engine.

The advantages claimed and amply supported for this latest development of the Diesel engine recall the glowing predictions originally made for the engine when it was first announced by Herr Dr. Rudolph Diesel, the German engineer, in the early nineties. An engine that required no external ignition system but whose fuel instead burned by the raising of the temperature in the cylinder by compression without any explosive shock! This was, and is, considered the summum bonum for internal combustion engines, and since 1912, when the Diesel patents expired, American ingenuity, notably the Worthington Pump and Machinery Corporation, has done much to bring the dream to practical realization.

The double-acting, two-cycle Diesel engine of the Worthington Pump and Machinery Corporation is the latest development in the progress of this astounding engineering discovery, being premised upon this company's long experience with the Diesel engine and the development of several other types in progressive improvement of the original Diesel principle.

In this latest Diesel engine the price per horsepower is reduced through a more complete utilization of the working parts; the overall dimensions are smaller; a given power can be produced with a small number of units, and cheaper types of generators can be used.

Blaw-Knox Purchases Milliken Brothers

The Blaw-Knox Company has purchased the Milliken Brothers Manufacturing Company, of New York. The consolidation of the two companies will become effective on September 1st.

The Blaw-Knox Company is well known because of its line of steel specialties including steel forms for concrete construction, steel buildings, open hearth furnace equipment, air preheaters, hammer welded products, steel transmission towers, automatic concrete measuring devices, steel bins, clamshell buckets, etc.

The Milliken Brothers Manufacturing Company was originally organized as Milliken Brothers, Inc., in 1857. The products of the Milliken Brothers Manufacturing Company are transmission towers, radio towers, and standard steel buildings. A considerable amount of the business of the Milliken Brothers Manufacturing Company has been in the export field and the present Milliken organization will continue to function in this field and in addition will take over the management of the export business of the Blaw-Knox Company on all of its products.

The Blaw-Knox Company will continue with its present organization to handle domestic business and the acquisition of the Milliken Company will make no change in this line. Manufacturing for both companies will be concentrated at the Blaw-Knox Company plants at Pittsburgh and Baltimore.

New Chain and Sprocket Catalog

Catalog Number 50 of the Webster Mfg. Company is a very well illustrated and informative catalog describing almost every conceivable kind and character of chain and sprocket useful for conveying material or driving machinery. The manner in which the information is portrayed in the catalog makes it easy for the buyer to determine his exact needs and to know the cost thereof. So many catalogs issued today lack one or more of the essentials of this buyer information that the method used in this Webster catalog might profitably be emulated by others. The price list is especially handy and covers a wide range of products. In the back of the catalog such accessories as elevator arms, pocket wheels, operating chains and traction wheels are described.

All malleable iron used in the Webster chain is tested daily in the laboratories of the American Malleable Castings Association and this procedure should give the buyer a sense of added protection in using the catalog to supply his needs.

A Practical Light Shovel

The "Speeder," a light yet highly efficient shovel for service that lies between hand labor and a heavy machine, is described in a recent circular of the Speeder Machinery Corporation.

The machine is of the familiar full revolving type mounted on a crawler truck. It is especially made for work that is not profitable to attempt with a heavy, large dipper shovel or a large, unwieldy crane. As a crane it can be used for the erection of steel in building or with a hook for handling heavy objects around warehouse or yard or with a magnet for handling scrap iron.

A 30 ft. boom is used for both clamshell and dragline work. No change in the machine is necessary other than changing the attachment itself and reweaving the cables. The operator is located in such a position that he can always see his work without twisting his neck. The skimmer attachment is provided for shallow, accurate cuts and may also be used as a pull shovel.

Two types of buckets are furnished, the boiler plate bucket for general excavation, and for solid rock excavation a Missabe bucket is recommended.

E. B. Perry Dead

Ernest Blackman Perry, president of the Industrial Works, Bay City, Michigan, passed away on July 31st at his home in Bay City, after a short illness.

He was born in Prairie du Chien, Wisconsin, December 9, 1868, receiving his early education in the public schools of Ann Arbor, Michigan, after which he entered the University of Michigan. Graduating with the degree of bachelor of science in mechanical engineering in 1889, he obtained the position of chief engineer of the Industrial Works, receiving his master's degree in mechanical engineering in 1896. In 1891 he was made superintendent and mechanical engineer, and later, vice-president and general manager of the Industrial Works.

In 1924 he became president of the concern and served in that capacity until his death.

On November 22, 1889, he was married to Susie I. Harwood, of Ann Arbor. To them were born two children, Harold H. Perry, one of the managing heads of the Industrial Works, and Ernestine H. Perry, both of whom survive.

He was a member of the American Society of Mechanical Engineers, Tau Beta Pi, national honorary engineering fraternity, Delta Upsilon fraternity, Rotary and various other organizations.

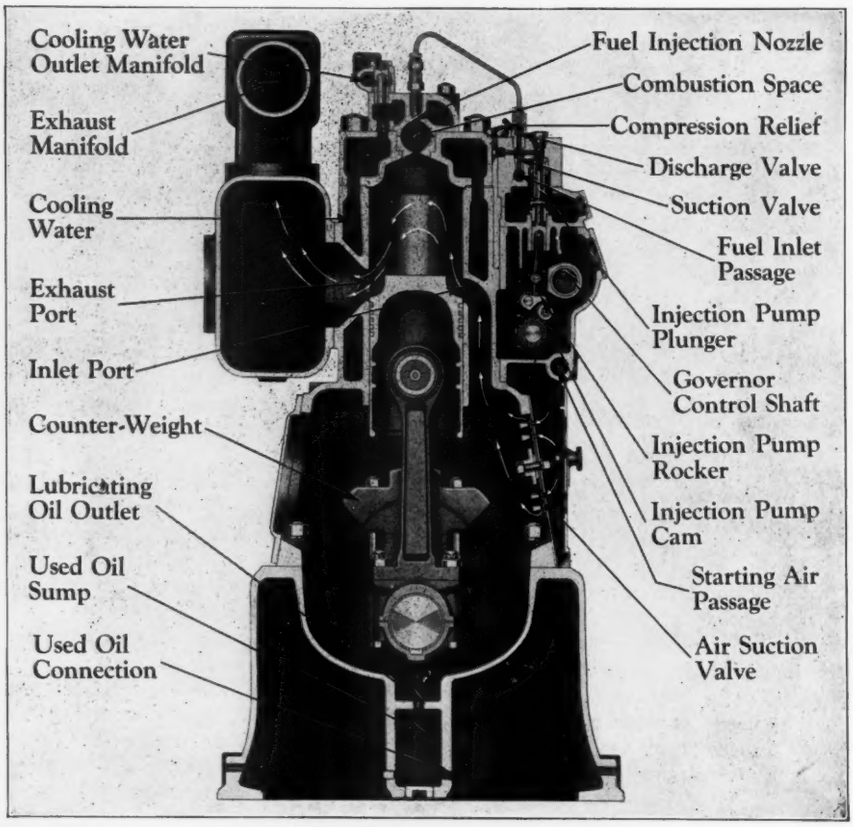
Falk Appoints New Agent

The Falk Corporation, manufacturers of herringbone gears, speed reducers, flexible couplings, oil engines and steel castings, announces the opening of an office in Portland, Oregon, at 720 Terminal Sales Building, 12th and Morrison Streets. This office will be in charge of Mr. John Jurgensen, who has been in the company's New York office for seven years.

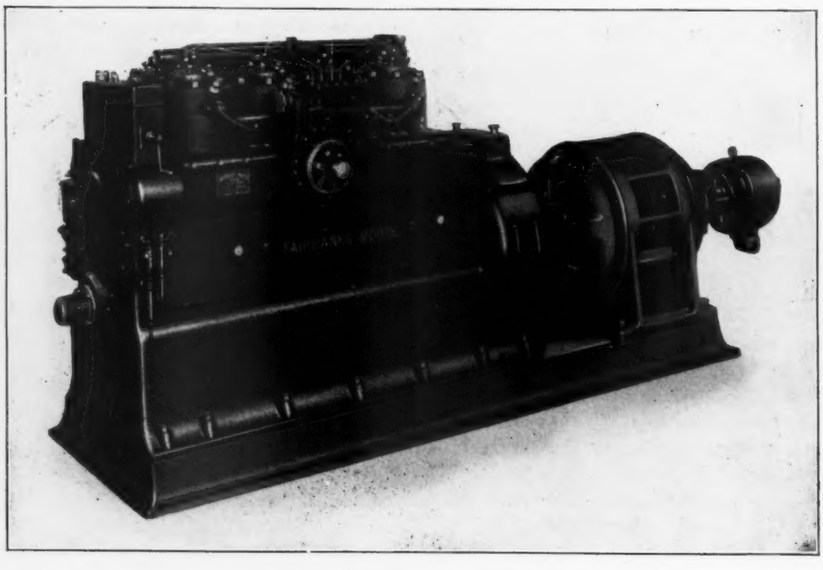
Small Unit Diesel Engines

Most of the developments in Diesel engines have been in connection with large sizes and not so much attention has been given the smaller units. In the past year, however, a number of higher speed, lighter weight Diesels have been brought out, placing the Diesel engine on a comparative basis with the gasoline engine in these similar sizes. There are so many places where the power problem can be solved by a self-contained prime mover in ratings from about 30 h.p. and up that these new developments are of decided interest.

The line of higher speed and lighter weight Diesels in ratings from 30 to 180 h.p. which has been developed by Fairbanks, Morse and Company illustrates this new trend in the power field. The accompanying cross section through one of these engines shows the simplicity of the modern Diesel engine in a striking way. In this engine the fuel oil is injected into the combustion space above the cylinder proper by means of a plunger pump which is driven by a cam mounted on a shaft running along the side of the engine about half way up. This shaft is driven by means of gears from the main crank shaft. One of these plunger pumps is required for each cylinder.



Cross Section of Modern Diesel Engine



Diesel Engine Power Generating Unit

The fuel is sprayed through a nozzle located at the top of the cylinder and the injection of the fuel is timed so that it enters the combustion chamber at about the time the piston reaches the top of its stroke.

Engines of the type shown in the accompanying illustrations are built in a number of modifications to meet practically every service requirement. For instance these engines can be equipped with radiator cooling and with a built-in clutch of the automobile type, for such applications as dredges, power shovels, locomotive type cranes and similar service. This same type of unit can also be equipped with a pulley and used for conveyor drives or any application where it is desired to use a belt drive. Since the speed of units of this type matches up with many types of driven machinery such as centrifugal or screw pumps, it is also possible to directly connect this type of engine to the driven machinery.

The new Fairbanks-Morse Diesel is equipped with both manual and governor control. In this control a half turn of the small regulator, shown just a little above the center of the engine is to be operated for long periods at a slow speed; the governor control wheel is turned and the engine operates at this slow speed under governor control, that is, the speed will not vary over or under the speed for which the governor is set.

This particular feature is exceptionally important where the engine is used for such service as a power shovel, but it is also useful in varying the voltage or frequency on direct and alternating current generating sets. These engines are started with compressed air at a pressure of about 250 pounds, which is supplied by a small air compressor and stored in small tanks. The engines start instantly and the starting of even the largest Diesel engine is easier than starting an automobile engine.

The Hercules Manufacturing Company has been incorporated for $25,000 at Portlock, Va., to engage in the business of manufacturing gypsum, plaster, etc.

Explosives Industry History in America

"The History of the Explosives Industry in America" was written by Arthur Pine Van Gelder and Hugo Schlatter, two nationally known explosives chemists, published by the Columbia University Press, New York, under the auspices of the Institue of Makers of Explosives, which has just come from the press, is the first definite history of that industry which has appeared in America. The book, which required three years to write, contains 1152 pages and carries 500 illustrations in halftones. It covers the entire history of explosives, with its many ramifications, from gunpowder days down to the present era of American industrial progress in which explosives have played, and are still playing a leading part.

Before the appearance of this volume, most of the literature on modern explosives in this country was to be found only in papers, usually of a technical nature, contributed to scientific journals and societies, and in house organs and trade journals. "The Rise and Progress of the British Explosives Industry," published in 1909, was fashioned somewhat like the new volume, but the British history is not as comprehensive and not nearly as complete as the present one.

In writing their history, Messrs. Van Gelder and Schlatter made extended and minute searches at the sources in official records, local histories, manufacturers' files and biographies, covering nearly 150 years. One of the most important things they did was to incorporate in the volume carefully checked data obtained from records in patent issues, particularly those pertaining to interferences and infringements. They are the first writers on the subject to make use of such material for general consumption.

As a result of their painstaking researches, the authors have written what amounts to an historical romance concerning America's key industry. The book is gratifyingly free of technicalities and statistics that otherwise would make the history dull reading. The average American, as he witnesses the ever changing world around him and particularly the progress and development of his own country, does not discern the important part explosives have played and are still playing in our industrial and commercial life. This volume, therefore, is a reminder of how a great industry has developed from a small begining in gunpowder days to a business which reaches a hand into all the industrial enterprises of the modern man.

The book is divided into six main divisions, namely, Black Powder, Dynamite and Nitroglycerin, Blasting Supplies, Smokeless Powder, Military Explosives and Explosives in the Making of America. But a mere enumeration of these topical headings does not begin to describe the exhaustive manner in which the authors have treated the marvelous development of the explosives industry and the romantic phases of that development. No enterprise of mankind is without its human element, and one of the noteworthy qualities of this history is its human interest aspect, written in a style that makes it comparable to an entertaining novel. In war and peace, it should be borne in mind, explosives have been the key industry, so that in war and peace pioneer explosives makers such as the du Ponts, the Laflins, Rand, Prickett, Hazard, Coleman, King and dozens of others, have wrought as thrillingly in the making of America as have many of the nation's more popularly known heroes. Some of the author's best strokes are in their descriptions of the lives of these pioneers.

The first sentence in the history's first chapter is the keynote in the development of gunpowder—"The discovery of firearms marks one of the most important events in the history of civilization." With that premise the authors carry the reader through some of the most eventful periods of our history to the present day when explosives have become the basic means of innumerable enterprises. They might have said, with equal emphasis, that the discovery of nitroglycerin and dynamite marks the most important event in industrial history. Consider, for example, the part that explosives play in mining ores and minerals, in the building of railroads, highways, canals, tunnels and aqueducts, in the deepening of waterways, in the removal of obstructions to navigation, in the erection of the world's large buildings, in the reclaiming of swamps and in the building of huge dams for hydroelectric developments. The list of modern enterprises in which explosives play a leading and primary part is almost endless and involves many technical details, but the authors of this history have described the ubiquitous explosives in American industry in such a way that the average reader will find enjoyment in the book.

The authors and their sponsors are to be congratulated for having produced a volume which is at once an historical romance and an exhaustive chronicle of the origin and development of one of man's chief industrial enterprises. The book affords entertainment and information for the layman, as well as an encyclopedia for the thousands of men and women who are engaged in the industry.

Crushing Rolls Described

The Traylor Engineering and Manufacturing Company has just issued Bulletin 2106 superseding Bulletin 1106 on the subject of "Heavy Duty Crushing Rolls." The new bulletin, which is printed on heavy eggshell paper in rotogravure style, is an unusually well done piece of work and contains much information of value to anyone interested in crushing rolls for stage reduction.

On the inside front cover of the bulletin the company gives a list of the products of its manufacture, which is followed by a general discussion of the uses of crusher rolls.

Some of the outstanding points in regard to the crusher rolls of this company's manufacture include a frame which is of the heaviest possible proportions throughout, especially designed for shock absorption; tension springs which are extra heavy, to assure holding the rolls up to their work at all times; oversize shafts to eliminate the possibility of deflection and bearings which are extra long and of extra large diameter to secure low pressure under the heavy duty to which these rolls are subjected.

The roll assembly is especially designed to facilitate the renewal of shells and the adjustment devices for regulating the size of product and the alignment are positive and easily operated. The automatic lateral adjustment or fleeting device assures maximum life of the roll shells by preventing flanging and annular corrugation. The driving pulleys are oversize, and, in the case of the flywheel type, are extra heavy for storing energy to minimize vibration.

Following the specifications for the crushing rolls the bulletin contains a parts list accompanied by diagrams, setting tables with diagrams, and a very interesting "percentage chart" by which the percentage of stone retained and the percentage of through for any given setting are quickly obtained. An interesting chart and description in the back part of the book enables the reader to determine the capacity in terms of tons per hour for any given roll under given settings and speed.

On the inside back cover of the bulletin appears an illustration of a large size crushing plant showing the manner in which the rolls may be used to increase the efficiency of the plant.

Clyde Hoists and Derricks

A recent leaflet put out by the Clyde Iron Works Sales Company describes their hoists and derricks. The company manufactures a line of electric, gas and steam hoists as well as a complete line of guy and stiff leg derricks. The electric hoists shown and described in the leaflet are of the one, two and three drum types from 5 to 125 h.p. The electric hoist has an automatic mechanical emergency brake, silent belt chain drive, machine cut gears and drum type controllers. Solenoid brakes can be supplied and a boom swinging gear or extra drum may be added, if desired.

The gas hoist is particularly for the use of contractors and is built in a range of sizes from 4 to 100 h.p. with single, double or triple drums. It has an automatic throttling governor, machine cut gears, silent belt chain drive and a multiple cylinder engine. On account of its easy portability and low operating cost it is especially suited to the contractor's use.

The steam hoists are built in sizes from 12 to 100 h.p. in the one, two and three drum types and are furnished with or without the boiler. This unit is manufactured with extra large piston rods, locomotive type crossheads, extra heavy shafting and is made of selected materials throughout.

New Low Speed Motor

A new low speed synchronous motor, called the type HR, has recently been placed on the market by the Westinghouse Electric and Manufacturing Company. The motor was especially designed for slow speed machinery where direct connection is applicable. Arc welding has been used extensively in this motor and its parts have been specially designed for ease of handling and assembling in the field.

This motor has been designed for high efficiency at all loads within its normal operating range. High efficiency at fractional loads is a great power saver, since few applications require the maximum output of the motor. The excitation has been materially reduced, thus increasing the efficiency and cutting operating costs. A difference of 1 per cent in efficiency on a 200 hp. motor running 24 hours a day for 250 days a year means a difference of $250 with power at 3 cents a kw.

A starting torque of 50 per cent and a pull in torque of 40 per cent are features of this new motor. The higher the starting torque, the quicker the motor will come up to normal running synchronous speed. The disturbance on the line is correspondingly reduced. This higher-than-usual torque is also a valuable asset under such unusual conditions as starting a machine while it is still new and stiff or after it has been standing for a considerable time.

This motor is particularly desirable for driving air compressors, although in the coupled type it is equally desirable for driving Jordans, pulp-grinders, pumps, and other slow speed machinery.

Brown Hoist and Industrial Plan Consolidation

Following close upon the announcement of the death of E. B. Perry, President of the Industrial Works, Bay City, Michigan, on Aug. 7th last, comes the further announcement that the directors of the Industrial Works and of the Brown Hoisting Machinery Company, Cleveland, have approved plans for the merger of the two companies, to be made effective when ratified by their respective stockholders at meetings which will be held in the near future.

The consolidation will join under one management over twenty-one hundred people and assets of approximately $13,000,000. The combined sales of both companies totalled over $7,700,000 in 1926. Both plants will be continued in operation and no radical changes of any kind are contemplated.

Discussions, leading to the merger, have been proceeding for many months, and the announcement is the culmination of intensive work on the part of the late E. B. Perry, president of the Industrial Works, Alexander C. Brown, president of the Brown Hoisting Machinery Company, and other executives of the two companies.

The Brown Hoisting Machinery Company was founded in 1880 by Alexander E. Brown and the plant of the company now occupies nine and one-half acres in the city of Cleveland. The company also owns an iron and bronze foundry at Elyria, Ohio, which occupies twenty-five acres of ground. The Industrial Works was founded in 1873 by George C. Kimball, James Clements, E. Wells and Charles R. Wells. The plant of the company occupies twenty-nine acres and includes sixty buildings at Bay City.

Cutler-Hammer Moves Cleveland Office

The Cleveland office of the Cutler-Hammer Company has been moved from the Guardian Trust Building to Suite 1905 of the Guarantee Title Building. The new office has aproximately three times the space of the old.

Trackson Company Appoints

The Trackson Company announces the appointment of two new distributors for its Trackson Full-Crawlers. The appointments are the William Ford Company, 15,841 Second Blvd., Highland Park, Michigan, for the Detroit territory, and the T. W. Meiklejohn Company, Fond du Lac, Wisconsin, for the Milwaukee territory. These companies will carry both the Standard Model F Trackson Full-Crawler and the heavy-duty Model D Trackson, as well as repair parts for both models.

The Trackson Full-Crawler is a full-length crawler for the Fordson which gives the tractor a sure footing in difficult ground conditions such as soft ground, mud, deep sand, snow, and ice, where wheel tractors cannot work. It adds weight to the Fordson for bearing down on hard pulls, and reduces the ground pressure to less than that of a human being, making it possible for the Trackson-equipped Fordson to stay on top in such conditions as bogs, swamp land, etc., where horses and other tractors mire easily.

Speeder Sales Conference

The Speeder Machinery Corporation, Cedar Rapids, Iowa, manufacturers of Speeder shovels, cranes, draglines and pull shovels, recently held a sales conference with their entire nationwide sales force in attendance.

The conference was under the direction of Mr. T. M. Deal, Sales Manager, and among other things, Mr. Deal took occasion to make an announcement of additions to both the sales and service departments in order to effectively carry out the Speeder Corporation's policy of "unexcelled service to the users of Speeder machines."

"Improvements in design," and "Service Speeder salesmen can render to the users of Speeder machines," were other topics discussed by Mr. Deal, as well as a complete outline of the sales policies and advertising program.

Mr. George T. Ronk, President and General Manager of the Speeder Corporation, in a very interesting talk, set forth the ideals and the policy of progressiveness of the company. A general get-together at which the company was host, was held the last day of the three-day conference.

R. H. McGredy Promoted

R. H. McGredy has been appointed sales manager of the hoist division of the American Engineering Company.

The Largest Shovel

The Northern Illinois Coal Corporation are soon to put in operation, on their property near Verona, Illinois, a Marion new Type "5480" electric stripping shovel, the largest ever built. The shovel is to be mounted on crawling traction trucks equipped with Marion hydraulic equalizing jacks which automatically hold the machine perfectly level while traveling or working on rough or uneven ground surfaces. It carries a 90-foot boom, 60-foot dipper handle and 12-cubic yard dipper and will strip overburden up to approximately 50-foot in depth. Although much heavier throughout, the design of the "5480" follows closely that of the Marion 350 which is so widely used in the coal stripping and ore mining fields.

The electrical equipment is manufactured by the General Electric Company and consists of two 255 h.p. motors on the hoist, two 75 h.p. motors on the swing and one 150 h.p. motor on the crowd, all motors being rated on a 60 minute basis. The motor generator set which furnishes power to the individual motors has a continuous rating of 700 KV-A. The range of the machine is approximately the same as that of the Type 350 and with the increased dipper capacity, is designed to establish a new record of 5 per cent more production than was possible heretofore.

Dry and Wet Pans Improved

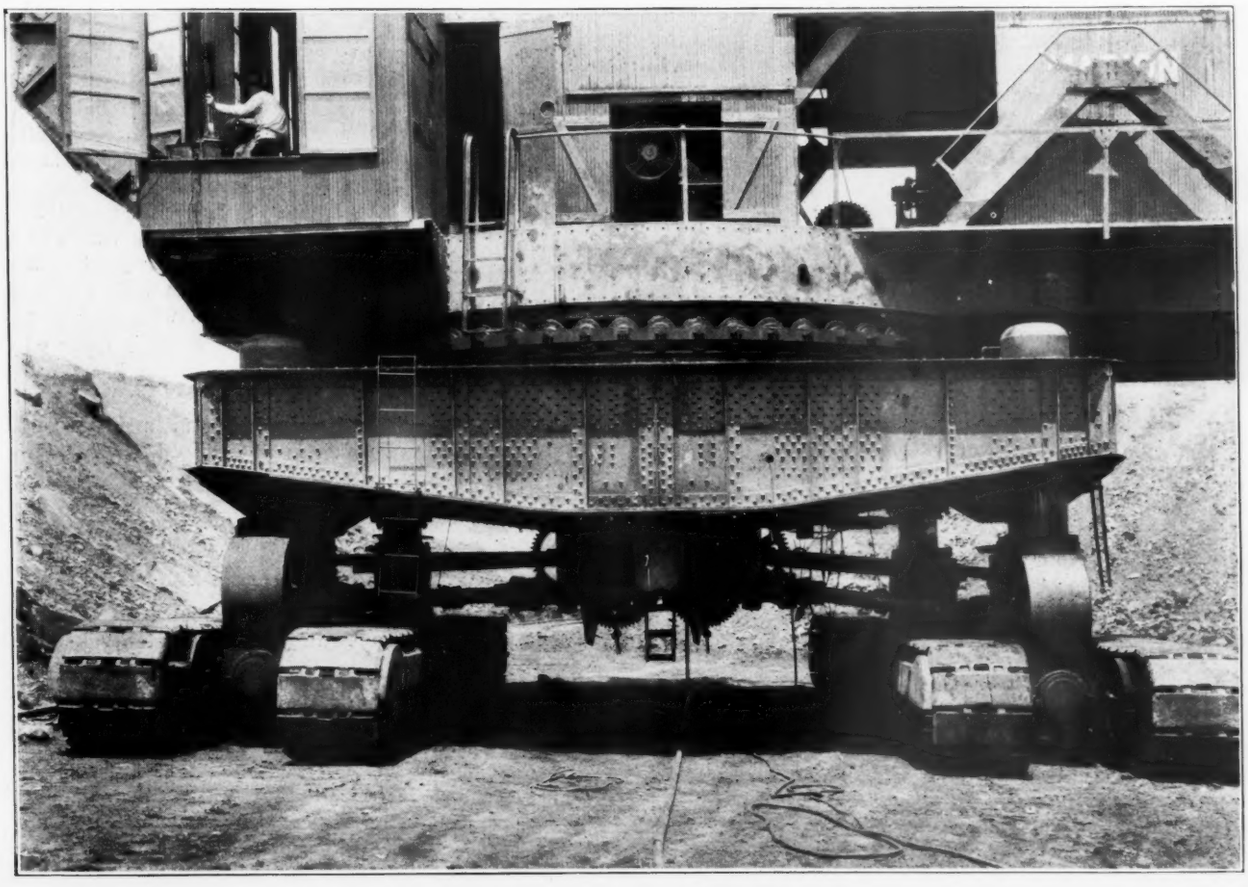
Improvements in the design of dry and wet pans are described in Bulletin 100 of the Bonnot Company, lately issued. All pan frames are made with machined joints, reducing vibration to a minimum. Steel castings have replaced cast iron for many of the parts and more convenient arrangements for lubrication have been provided.

The crown wheel is made with a removable rim and the molar tires are cast in metal chills, giving them greater wear-resisting qualities. Timken roller bearings may be had for the step bearing and the muller shafts. Side frames are heavily ribbed to insure strength and have a machined socket to receive the ends of the cross frame, which is also machined. When bolted together this three piece construction forms a rigid and vibration-resisting frame which is designed to give long service.

The bed plate or pan bottom is a rugged casting, reinforced with ten ribs. In the heavy nine foot pans and all the ten foot pans this casting is of open hearth steel. This casting is machined to receive the arms which carry the screen plates and also where the wearing plates rest. Forged steel upright or main shafts are used in all pans. A heavy collar is forged on this shaft for carrying the bed plate.

The crown gear is made with removable rim. The joint where the rim is bolted to the center or spider is machined and drilled with a jig to insure the proper fit when renewal is necessary. The gear rim is made of a special metal and the pinion is a steel casting. The wearing plates are made of a special analysis of hard iron to resist wear and they are bolted to the bed plate. Screen plates are furnished for the nine and ten foot pans in either one or two pieces to suit the needs of the particular job where they are to be employed, one piece plates only being furnished for the smaller sizes of pans.

The wet pans are constructed with the same general features of the dry pans, discharge being accomplished by means of a swivel scoop. The standard step bearing consists of an outer oil-tight casing with a cover clamped to the shaft and arranged to exclude dust. Inside of the casing are two polished chilled metal plates, the lower one being held stationary and the upper one revolving with the shaft. Between these two polished plates is a disc of anti-friction bronze. This step is easily lubricated through an oil pipe which extends outside the pan.



New Type Marion Electric Stripping Shovel

New Three Ton Lift Truck

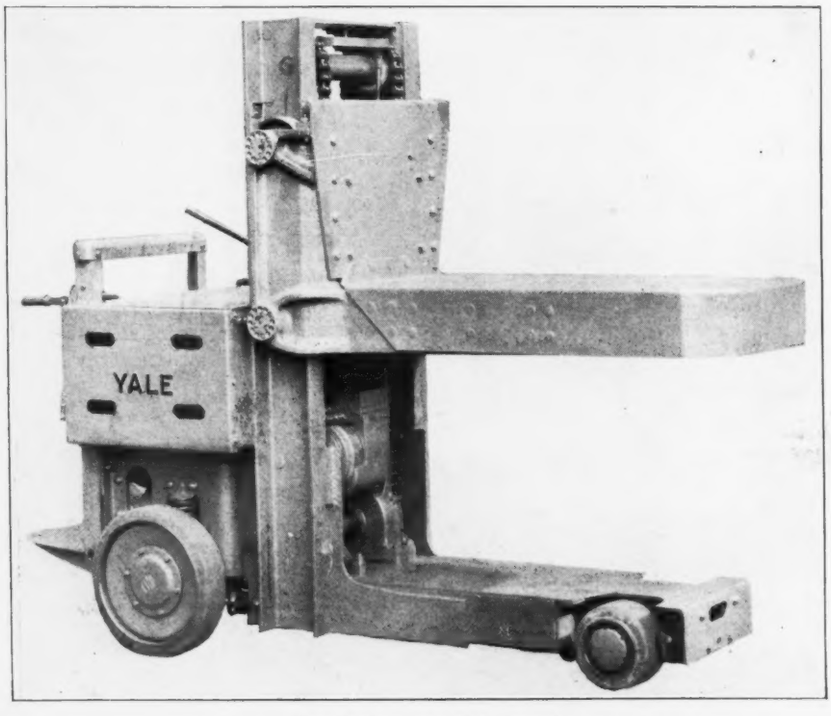
Model K25, 3-ton high-lift, elevating truck has been added to the Yale line in order to fulfill the requirements for ever increasing loads on electric industrial trucks. Advantage has been taken of the excellent features that experience has introduced into the older units, and at the same time economies have been maintained by the use of pressed steel, drop forgings, dies, and general production methods.

The elevating platform is raised and lowered through the medium of a 1½ inch diamond roller chain, passing over a power-driven sprocket at the bottom, and an idler sprocket at the top. In order to reduce friction to a minimum, Hyatt heavy duty roller bearings are employed in the idler sprocket at the top of the machine. The shifts of the lower sheaves run in a bath of oil, which also serves to lubricate the spurgear reduction unit. The two ends of the roller chain are attached to the platform through a spring take-up device, which will automatically adjust itself as the chain wears. It is estimated that the life of this hoisting chain in normal service will exceed five years.

The hoisting motor is connected to the spur-gear pinion through a spring ratchet, so arranged that a positive drive is obtained when raising the elevating platform. If, however, the platform was checked in its downward travel, the ratchet would merely release, and, therefore, cause no injury to the mechanism of the truck. The ratchet when slipping makes considerable noise, so that the operator is immediately warned of the fact that the truck platform is bearing on some obstruction. A speed of 7½ feet per minute is obtained when lifting a full load, and a speed of 19 feet per minute when raising the empty platform. The lowering speed is 19 feet per minute loaded or empty. The platform has an overall width of 27 inches, a height of 11 inches and a length of 54 inches.

By placing the elevating or hoist unit between the vertical roller channels, all of the available space is utilized, with the result that the overall length of the machine when in operating condition is cut to a minimum. The hoist unit in this position is accessible for any servicing or inspection that may be required, and provides the further advantage that it separates the elevating roller channels a distance sufficient to give a very high degree of visibility for the operator when driving the machine.

In order to reduce the physical effort necessary to steer a machine of this heavy capacity, the steering knuckle king pins have been fitted with ball and roller thrust bearings which puts the entire weight of the machine on anti-friction bearings. On the small wheels, which come directly beneath the load, the steering knuckle king pins, in addition to being fitted with the roller thrust bearings, are also equipped with an upper and lower roller bearing to take the radial load. Tests made with this machine carrying the full capacity load of 6,000 pounds, show that the pressure required at the operator's handle to steer the wheels is less than was formerly required on the 2-ton machines which were equipped with hardened pins and ground bushings where roller bearings are now employed. A four wheel steer feature allows a turning radius of 96 inches to the outside edge of the truck.



New Three Ton Lift Truck

Convertible Power Shovel Uses Fordson Power

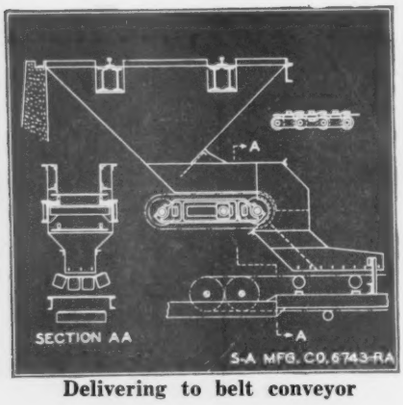
The Wilford power shovel, manufactured by the Universal Power Shovel Company, was designed to offer the economies of a small power shovel for work particularly fitted to its use. It was found that the Fordson tractor power unit furnished sufficient power to permit the use of a fifteen foot boom and ten foot dipper stick as standard equipment. On some special installations even longer booms have proven satisfactory.

Speedy operation is made possible by one-man operation, the operator working from a single reversible seat. Controls are conveniently located and the machine will travel at from two-and-one-half to three miles per hour on its own power.

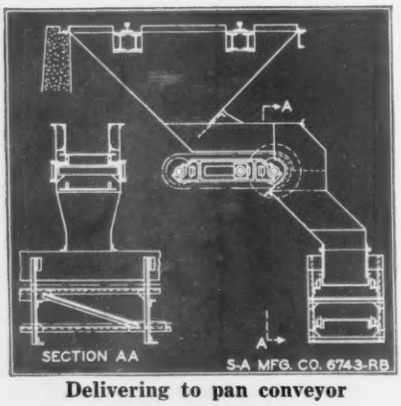
To change from the moving to the digging position requires but a moment. The operator simply swings around in his seat and is ready to start.

This power shovel is quickly converted into either a clamshell or crane, when desired. The machine weighs approximately seven-and-three quarters tons and is equipped with a rugged crawler type track. The dipper is of one-quarter yard capacity, water level measure, and is of welded plate construction with four manganese teeth. The boom is made of two 7 inch channels, fifteen feet long, built together, and raised or lowered by a self locking worm and worm gear which hold the boom to any desired angle. The dipper handle is of channel construction comprising two 5 inch members, ten feet long. The dipper handle socket is an electric steel casting, with adjustable dipper braces to change the rake of the dipper. The crowding device is operated by a Ford one-ton truck worm gear and is reversed by two bevel pinions. The crowding drum is mounted on the worm gear shaft and no shipper shaft pinions, gears or brakes are used with this arrangement. A single cable operates the dipper handle up or down, independent of the hoist, the usual dipper handle racking being eliminated.

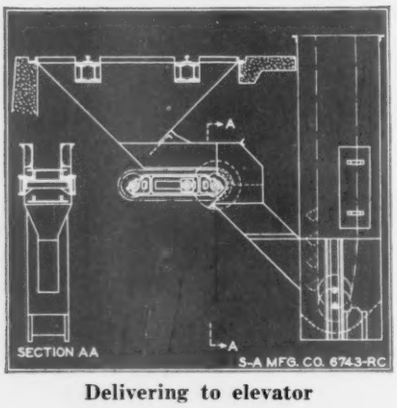
A few of many installations and adaptations of self-contained feeders



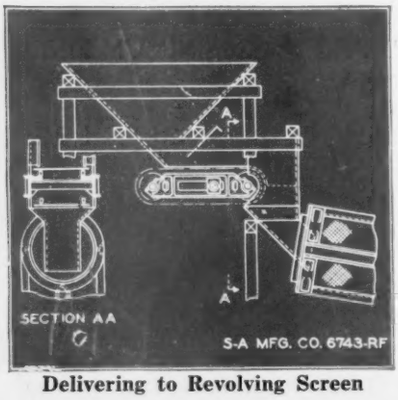
Delivering to belt conveyor



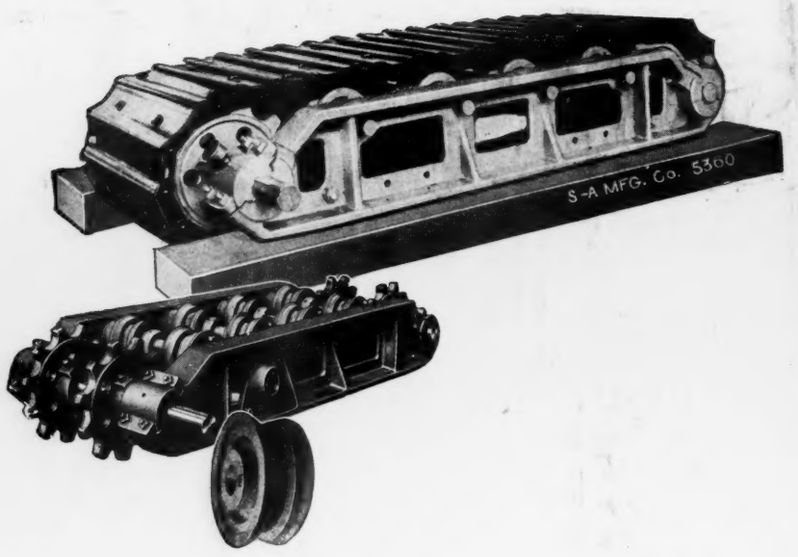
Delivering to pan conveyor



Delivering to elevator



Delivering to Revolving Screen



S-A Roller Track type Feeders minimize wear

Heavy lump material is handled by these feeders with a minimum of wear upon the feeder, due to the large diameter rollers which support the carrying run of the chain, taking the place of the usual track.

Spaced at close intervals, these wide shouldered track rollers allow the chain side-bars to roll forward, while grooves in the track rollers permit the chain rollers to pass without contact. This arrangement relieves the chain of all wear except for the slight bend made in passing around the end sprockets.

Heavy cross shafts carry the track rollers and rotate in bearings which are a part of the side frames. As these bearings are easy to reach, lubrication is a simple matter.

Roller track feeders are built with self-contained cast frames as shown above or in larger sizes with structural steel frames. They are easy to install, require comparatively little head room and because of the roller track principle require very little attention.

STEPHENS-ADAMSON MFG. CO.
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